PART II.

LITERARY AND MISCELLANEOUS.

PART II.

LITERARY AND MISCELLANEOUS.

CHAPTER I.

REMARKS ON THE CLIMATE AND VEGETABLE PRODUCTIONS OF THE HUDSON'S BAY COUNTRIES.

BY JOHN RICHARDSON, M. D., MEMBER OF THE WERNERIAN SOCIETY.

Communicated by the Author.*

THE following observations have been thrown together, and the subjoined tables drawn up, principally with the view of making public the few facts collected during Captain Franklin's late expedition through the Hudson Bay territories, that relate to the inquiry so ably prosecuted by Baron Humboldt, into the *geographical distribution of vegetable forms*, and on which so much light has been thrown by the observations of our learned countryman Mr Brown. Occasion has also been taken, in the course of the paper, to insert as many circumstances relative to the *climate* of these northern countries as were known to us.

The expedition landed at York Factory, Hudson's Bay, in lat. 57° long. 92°, (a few miles to the westward of the line of no variation of the magnetic needle, and nearly in the longitude assigned by Dr Brewster to *one of the poles of cold*, but 23° to the southward of it,) and travelling on a W.S.W. direction, reached Carlton House, on the Saskatchawan, distant in a direct line about 430 geographical miles. This place is in lat. 53° long. 106° W., and lies nearly midway between the Pacific and Hudson's Bay; the Continent here being about 33° of long., or 1000 miles wide. From Carlton House, the course, for 1000 miles, was north, inclining to the west, to the mouth of the Coppermine River, in lat. 67° 47′ N. long. 115°½ W.

All the plants collected up to this point, amounting, *Agamæ* inclusive, to nearly 700 species, and to at least 5000 specimens, were brought home, and form the ground-work of the subjoined tables of natural families. About 500

* Read before the Wernerian Natural History Society, 8th and 22d January, 1825.

miles of sea-coast, including the circumnavigation of the bays and inlets, were visited to the eastward of the Coppermine River, and the latitude of 68° 18′ N. attained at Point Turn-again; but the whole of the plants collected during this part of the voyage were left behind, owing to the hardships encountered in the subsequent return across the barren grounds. This loss has been supplied, as far as regards the purpose of the present paper, by the collections made during Captain Parry's second voyage in the same parallels of latitude, and at no great distance to the eastward.

In making a few desultory remarks upon the circumstances which are likely to influence the vegetation of the districts, I shall begin with their altitude above the sea; and it is almost superfluous to remark, that we have few precise data on this subject, and must for the present be content with rude approximations. The line of country travelled through is destitute of lofty mountains, table-lands, or great plains; except that Carlton House may be said to stand on the northern boundary of a sandy plain, which, opening to the south, and extending to the confines of Mexico, is favourable to the migration of plants to the northward; but our stay in that quarter being confined to ten days at the commencement of spring, during which only thirty species of plants were gathered, few of these southern plants find a place in our list. Few hills were seen during the whole voyage, rising beyond 300 or 400 feet above the level of the surrounding country, and none exceeding 800, except on one part of the Coppermine River, where a range was observed to rise, on a rough estimation, to 1200 or 1500 feet; but even this was free from snow in the beginning of July.

Indeed our route, being by the great rivers, and almost uninterrupted water communications of the districts, was necessarily through the lower part of the country. Our barometer was rendered useless soon after leaving York Factory; so that I can only state in general terms, that, from the shores of Hudson's Bay to the Rocky Mountains, (a continuation of the Andes,) the ascent appears to be gentle, most rapid, however, about fifty miles from Hudson's Bay, where the rivers, in crossing a ridge of primitive mountains, form a quick succession of cascades and rapids.

Carlton House, the south-west limit of our journey, I estimate to be 1000 feet above the sea of Hudson's Bay. From this spot, our route to the north lay nearly parallel to the Rocky Mountain chain.

The summit of Portage La Loche, or Methy Portage, which lies in 56° 43′ N. lat., and 109° 52′ W. long., and is about 250 miles from Carlton House, I estimated at 1500 feet. Methy Lake, the commencement on the south of this portage, of the water communication with Hudson's Bay, at 1000 feet, and Clearwater River, which flows from the north side of the Portage uninterruptedly to the Arctic Sea, under the names of Athabasca, Slave River and Lake, and Mackenzie's River, at 800 feet. Slave Lake at 400 feet above the Arctic Sea. The height of land to the north of Fort Enterprise, from whence the descent of the Coppermine River to the Arctic Sea, is gradual, at 900 feet. The data from which these altitudes have been deduced are not precise enough to be worthy of detail; but the results, imperfect as they are, may be sufficient to show that the elevation alone of these districts is not great enough to give a decided character to their vegetation.

The peculiarities of the Hudson's Bay climate, which have a more marked influence on the vegetable productions, may be, in some measure, collected from the following tables, and

the remarks appended to them. The tables are formed on the model of those given by Humboldt, and the deeply interesting memoir of that illustrious man on the *Distribution of Heat*, published in the *Mémoires d'Arcueil*, or its translation in the 3d, 4th, and 5th volumes of the Edinburgh Philosophical Journal, may be referred to, for the original views which prompted the formation of such tables, and the many interesting deductions that may be made from them.

TABLE I. *Exhibiting the Mean Temperatures in various Latitudes.*

MONTHS.	Mean Temperature of the Air in the Shade.				
	Cumberland House, Lat. 54° Long. 102¼° W.	Near Fort Enterprise, Lat. 64° Long. 113° W.	Winter Island, Lat. 66½° Long. 83½° W.	Igloolik, Lat. 69½° Long. 82½° W.	Melville Island, Lat. 74½° N. Long. 111° W.
	1819—20.	1820—21.	1821—22.	1822—23.	1819—20.
	°	°	°	°	°
September,.....	+ 49.20	+ 34.30	+ 29.06	+ 22.45	+ 22.54
October,.....	+ 36.68	+ 23.94	+ 10.21	+ 10.29	— 6.96
November,.....	+ 14.60	— 0.23	+ 4.75	— 23.37	— 25.60
December,.....	+ 2.14	— 29.12	— 16.94	— 32.80	— 26.79
January,.....	— 14.19	— 15.08	— 27.96	— 22.07	— 35.09
February,.....	— 1.82	— 24.80	— 29.97	— 25.41	— 37.19
March,..... ...	+ 11.09	— 11.07	— 15.64	— 24.75	— 23.10
April,.....	+ 33.97	+ 5.11	+ 2.51	— 4.68	— 11.87
May,.....	+ 49.05	+ 32.11	+ 21.09	+ 22.85	+ 14.16
June, ...	+ 59.88	+ 46.62	+ 31.97	+ 30.16	+ 34.24
July, ...	+ 69.80	+ 53.20	+ 36.34	+ 40.04	+ 42.41
August, ...	+ 73.73	+ 55.36	+ 36.68	+ 33.68	+ 32.68
Annual Means,..	+ 32.01	+ 14.19	+ 6.84	+ 2.20	— 1.71

Remarks upon Table I.

The temperatures for lats. 54° and 64°, were deduced from Captain Franklin's observations: those in the three remaining columns are copied from Captain Parry's journals, with the modifications noticed below.

Cumberland House is situated in lat. 53° 57′ N. long. 102° 17′ W., in a flat limestone country, covered with wood, and abounding in swamps and lakes. The month of September was occupied in travelling from lat. 57° to 54°, for which an allowance has been made in the table at the rate of 1°.8 of temperature for each degree of latitude, by which the place of observation exceeded 54°; and the same addition was made to the recorded temperatures for June, July, and August 1820; during which months we travelled from Cumberland House to lat 64½° N. The allowance of 1°.8 here used is greater than that which Humboldt specifies for the same parallel of latitude; but it was obtained from a comparison of the mean annual tem-

peratures of Cumberland House and Fort Enterprise, which are 10½ degrees of latitude apart. The observations for the other months in the Cumberland House column, were made within the stockade of the fort, and a deduction of 1° has been made from each recorded observation, to compensate for the radiation from the neighbouring buildings—an allowance which corresponded with the few observations we made upon the subject. The means for some of the months were deduced from three or more observations each day, taking into account the length of the intervals. In the rest of the months, the means of the extremes have been used, which differ only in a fraction of a degree from the more correct mode of taking the intervals into account.

The temperatures in the column for lat. 64° were (except those for the latter end of June, the month of July, and the beginning of August) taken at Fort Enterprise, in a shaded situation, on a northerly exposure, and not subject to any material radiation from warm buildings; and an addition of 0°.5 has been made to the registered temperatures, as a reduction to lat. 64°; Fort Enterprise being actually 28 miles north of that latitude. The temperatures for July, and the early part of August, in this column, having been observed during the journey from the parallel of 55½°, an allowance of from 1°.5 to 1°.8 has been deducted for each degree of latitude, according to the situations of the places of observation. The temperatures for June, after the 10th, were taken in lat. 65°, and have therefore been corrected for lat. 64° by an addition of 1°.5 Fahr.

With regard to the temperatures in the three remaining columns, Captain Parry observes, "that the thermometer, when placed on the shore, or on the ice, at a distance from the ship, invariably stood from 3° to 4° or 5°, and on some occasions 7° lower than the temperature registered on board;" and he in consequence deducts 3° from the mean temperature for the year. In the above table, an attempt has been made to proportion the compensation for the warm atmosphere of the ships, amongst the months, so that the greater allowance is made when the difference of temperature between the atmosphere and ship was greatest, or, in other words, in the coldest months. Thus, in July and August, when the radiation of the earth is supposed to be nearly equal to that of the ship, the registered temperatures are used without alteration. In the other months, a deduction has been made, increasing from 2° to 5°, as their mean temperatures decreased. The annual means thus obtained are nearly the same with Captain Parry's corrected temperatures; but the differences betwixt the summers and winters a little exceed those given by his tables.

The means were obtained by Captain Parry from the twelve daily observations, made at intervals of two hours, or from 4380 observations in the year, and thus possess a degree of accuracy which is very rarely attained.

TABLE II. *Showing the Distribution of Heat in the different Seasons, in various Latitudes.*

SEASONS.	Mean Temperature of the Air in the Shade.				
	Cumberland House, Lat. 54°	Near Fort Enterprise, Lat. 64°.	Winter Island, Lat. 66½°.	Igloolik Lat. 69⅓.	Melville Island, Lat. 74½°.
Six Summer Months, April—September,	+ 55°.97	+ 37°.78	+ 26°.28	+ 24°.08	+ 22°.36
Six Winter Months, October—March,	+ 8.12	— 9.39	— 12.59	— 19.68	— 25.79
Spring,—March, April, May,	+ 31.37	+ 8.72	+ 2.65	— 2.19	— 6.94
Summer,—June, July, August,	+ 67.80	+ 51.71	+ 35.00	+ 34.63	+ 36.44
Autumn,—September, Oct. Nov.	+ 33.49	+ 19.34	+ 14.67	+ 3.12	— 3.34
Winter,—December, Jan. Feb.	— 4.62	— 23.03	— 24.96	— 26.76	— 33.02
Mean Annual Temperatures,.....	+32°.01	+ 14°.19	+ 6°.84	+ 2°.20	— 1°.71

TABLE III.

PLACES.	Position. Lat. N.	Position. Long. W.	Height in Feet.	Mean Annual Temperature.	Distribution of Heat in Seasons. Mean Temp. of Spring.	Mean Temp. of Summer.	Mean Temp. of Autumn.	Mean Temp. of Winter.	Mean Temp. of warmest month.	Mean Temp. of coldest month.	Diff. betwixt 3 summer and 3 winter months.	Diff. between hottest and coldest months.	Highest Tem. observed.	Lowest Tem. observed.	Diff. or extreme annual range.
	° ′	° ′		°	°	°	°	°	°	°	°	°	°	°	°
Cumberland House,	53 57	102 17	800	+ 32.01	+ 31.37	+ 67.80	+ 33.49	— 4.62	73.73	— 14.19	79.42	87.92	+ 87	— 44	131
Near Fort Enterprise,	64 0	113 6	850	+ 14.19	+ 8.72	+ 51.71	+ 19.34	— 23.03	+ 55.36	— 29.12	74.74	84.48	+ 78	— 57	135
Winter Island,	66 11	83 30	0	+ 6.84	+ 2.65	+ 35.00	+ 14.67	— 24.96	+ 36.68	— 29.97	59.96	66.65	+ 54	— 42½	96½
Igloolik,	69 19	82 30	0	+ 2.20	— 2.19	+ 34.63	+ 3.12	— 26.76	+ 40.04	— 32.80	61.39	72.64	+ 50	— 50	100
Melville Island,	74 45	111 0	0	— 1.71	— 6.94	+ 36.44	+ 3.94	— 33.02	+ 42.41	— 37.19	69.46	79.60	+ 60	— 55	115
From Humboldt:															
Transatlantic region,	...	58 to 72	0 to 0	32	...	+ 55.40	...	+ 1.40	...	...	54.00				
Labrador,	53 0	57 40	0					+ 3.20			48.00	63.00			
Labrador, Nain,	57 08	61 20	0		+ 23.90	+ 51.80	...	...	...	...					
Churchill, Huds. Bay	59 02		0	+ 26.42	+ 48.38	+ 33.44	— 0.60	+ 51.80	— 11.20	48.98					
				+ 25.03	+ 52.20		— 6.80				59.00				
Europe:															
Enontekies,	68 30	20 47 E.	1356	+ 26.96	+ 24.98	+ 54.86	+ 27.32	+ 0.68	+ 59.54	— 0.56	54.18	60.12			
Hospice de St Gothard,	46 30	8 23	6390	+ 30.36	+ 26.42	+ 44.96	+ 31.82	+ 18.32	+ 46.22	+ 15.08	26.64	31.14			
North Cape,	71 0	25 50	0	+ 32.00	+ 29.66	+ 43.34	+ 32.08	+ 23.72	+ 46.58	+ 22.10	19.63	24.48			
Umeo,	65 50	20 16	0	+ 33.26	+ 33.80	+ 54.86	+ 33.44	+ 12.92	+ 62.60	+ 11.48	41.94	51.12			
Uleo,	65 3	25 26	0	+ 35.06	+ 27.14	+ 57.74	+ 33.96	+ 11.84	+ 61.52	+ 7.50	45.90	54.02			

TABLE IV. *Showing the Increase of Vernal Temperature.*

NAMES OF PLACES.	Latitude.	March.	April.	May.	June.	Difference of the Temperatures of the Four Months.			Mean Temp. of the year.
Continental Climate:	° ′	°	°	°	°	°	°	°	°
Umeo, ...	63 50	+ 28.0	+ 34.2	+ 43.7	+ 55.0	11.2	9.5	11.3	33.3
Uleo, ...	65 0	+ 14.0	+ 26.2	+ 41.0	+ 55.0	12.2	14.8	14.0	33.1
Enontekies, ...	68 30	+ 11.5	+ 26.6	+ 36.5	+ 49.5	15.1	9.9	13.0	27.0
Cumberland House,	53 57	+ 11.1	+ 34.0	+ 49.1	+ 59.9	23.0	15.1	10.8	32.0
Fort Enterprise, ...	64 0	— 11.1	+ 5.1	+ 32.1	+ 46.6	16.2	27.0	14.5	14.2
Climate of Coast:									
Winter Island, ...	66 11	— 15.6	+ 2.5	+ 21.1	+ 32.0	18.1	18.6	11.0	6.8
Igloolik, ...	69 19	— 24.7	— 4.7	+ 22.0	+ 30.2	20.0	26.7	10.0	2.2
Melville Island, ...	74 45	— 23.	— 11.9	+ 14.2	+ 34.2	11.2	26.1	20.0	— 1.7
North Cape, ...	71 0	+ 25.0	+ 30.0	+ 34.0	+ 40.0	5.2	4.0	6.1	+ 32.0

TABLE V. *Comparing the number of days that reach temperature* 51°.8, *and the Warmest Months of various Latitudes, and Isothermal Lines, (Lines of equal Annual Temperature).*

Isother. Lines of	NAMES OF PLACES.	Lat.	Mean Temp. of the year.	Sum of the Temperatures of the Months that reach 51°.8.	Number of those Months.	Mean Temp. of days which reach 51°.8.	Mean Temp. of warmest months.	OBSERVATIONS.
		° ′	°			°	°	
32°	Umeo -	59 56	38.8	236	4	59.0	65.7	East of Europe.
		53 50	33.3	118	2	59.0	62.6	Gulf of Bothnia, east coast.
	North Cape,	71 0	32.0	0	0	0	46.6	Interior climate.
	Enontekies,	68 30	27.0	116	2	58.1	59.5	Continental climate.
	Cumberland House,	53 57	32.0	213	3	66.5	73.7	Continental climate.
59	Nismes,	43 50	60.3	593	9	65.8	78.3	Basin of Mediterranean.
53.6	Philadelphia,	39 56	53.4	463	7	66.2	77.0	
50	Buda, -	47 29	51.1	323	5	64.6	72.0	Interior climate.
41	Upsal, -	59 51	41.9	229	4	57.2	61.9	
10	Fort Enterprise,	64 28	13.7	108	2	uncertain	54.6	Continental climate.
	Winter Island,	61 11	6.8	0	0	0	36.7	Coast.
Zero,	Igloolik,	69 19	2.2	0	0	51.8 1 day	40.0	Coast.
	Melville Isl.	74 45	— 1.7	0	0	51 1 1 day	42.4	Partly interior climate.

Remarks on the preceding Tables, principally with a reference to the Climate of Cumberland House.

Humboldt informs us, that "in all places whose mean temperature is below 62°.6, the revival of nature takes place in spring, in that month whose mean temperature reaches 42°.8 or 46°4. When a month rises to

41°.9, the peach-tree (*Amygdalus Persica*) blossoms;

46°.8, the plum-tree (*Prunus domestica*) blossoms;

51°.8, the birch-tree (*Betula alba*) pushes out leaves.

"Barley, in order to be cultivated to advantage, requires, during ninety days, a mean temperature of from 47°.3 to 48°.2.

"In reference to the culture of useful vegetables, we must discuss three things for each climate; the mean temperature of the entire summer, that of the warmest month, and that of the coldest month.

"By adding the mean temperatures of the months that rise above 51°.8, that is, the temperature of the months in which trees with deciduous leaves vegetate, we shall have a sufficiently exact measure of the strength and continuance of vegetation."

Wahlenberg has also remarked in his *Flora Lapponica*, that "the air must acquire a mean temperature of 4° centigrade, or 39°.20 Fahr., before the frozen rivers break completely up."

The river Saskatchawan, which flows about two miles an hour at Cumberland House, broke up on the 28th April, 1820, the mean temperature of the ten preceding days having reached only 36°; but it is to be noticed, that one of the principal branches of this river rises in a more southerly latitude.

The narrow but deep streams which flow from Pine Island Lake, on which Cumberland House stands, into the Saskatchawan, did not freeze at any time during the winter; a circumstance to be attributed to their receiving a constant supply of warm water from the bottom of the lake. The lake itself was covered with ice about three feet thick.

The phenomena of spring, however, are perhaps most readily exhibited in a tabular form.

TABLE VI. *Tabular View of the Phenomena marking the Progress of Spring at Cumberland House, Lat.* 63° 57′, *Long.* 102° 17′ *W.*

Date.	*Means for the Month and 10 days preceding the respective Phenomena.*				Highest Temperature observed within 10 preceding days.	PHENOMENA.
	Mean Temp. of preceding month.	Mean Temp. of preceding 10 days.	Means of Maxima for 10 days.	Means of Minima for 10 days.		
1820.						
Mar. 8.	...	...	...	...	...	The snow covering the ground to the depth of three feet, was first observed to moisten in the sun, the temperature in the shade having risen to + 27° Fahr.
10.	...	+ 1.0°	+ 11.0°	— 9.0°	+ 27°	
12.	...	...	...	...	...	Temp. in the shade rose to 30°, and the melting snow began to drop from the eaves of the houses.
20.	...	+ 18.0	+ 27.6	+ 7.6	+ 39½	
21.	...	...	...	...	...	The temp. this day rose in the shade to 40°, patches of earth became visible from the wasting of the snow, and the River Saskatchawan broke up partially.
22.	...	...	...	...	...	On the 22d the highest temperature of the air was + 26°; but the surface of the snow, which was moist in the sun, was observed to assume a bluish hue, from myriads of minute hemipterous insects, which made their way through it with great rapidity, and were, without injury to their vital powers, frozen up with the snow after sunset.
24.	...	...	...	...	...	A white-headed eagle seen. Temp. 50°.
28.	...	...	...	...	...	Temp. in the shade 29°. Many grasses and bents (*Carices*) were observed shedding their seeds, which had withstood the winter firmly grasped in their glumes. This circumstance, and the sap still remaining in the culms, renders the hay or grass of the swamps nutritious to cattle in the winter of these climates.
31.	+ 11.1	+ 15.2	+ 24.2	+ 6.3	+ 50	
April 2.	...	...	...	...	...	The temperature sunk yesterday to — 14°, and did not rise to-day above + 20°. The River Saskatchawan is again frozen up.
7.	...	...	...	...	...	Rooks seen to-day.
9.	...	...	...	...	...	A merganser seen.
10.	...	+ 25.0	+ 35.0	+ 15.0	+ 49	Willow catkins beginning to burst.
12.	...	...	...	...	...	Geese and swans seen. Temp. in shade + 51°. Wind SE.

TABLE VI.—*Continued.*

Date.	*Means for the Month and 10 days preceding the respective Phenomena.*				Highest Temperature observed within 10 preceding days.	PHENOMENA.
	Mean Temp. of preceding month.	Mean Temp. of preceding 10 days.	Means of Maxima for 10 days.	Means of Minima for 10 days.		
1820.						
April 13.	...	...	...	...	...	Poplar catkins bursting. Temp. + 54°.
14.	...	...	...	...	...	Duck killed. Temp. in shade + 62°.
17.	...	...	...	...	...	Plovers, grackles, and orioles seen. Temp. in shade + 75°.
18.	...	...	...	...	...	Canadian jays and flycatchers seen. Highest temp. to-day + 38°, and at midnight on the 19th the thermometer sunk to + 21°.
20.	...	+ 50.6	+ 60.5	+ 40.9	+ 75	Tussilago flowering. Highest temperature to-day + 34°.
26.	...	...	...	...	...	Alder (*Alnus glutinosa*) flowering. Temp. + 46°.
28.	...	...	...	...	...	River Saskatchawan completely broken up.
30.	+ 34.0°	+ 35.5	+ 43.0	+ 28.0	+ 54	
May 1.	...	...	...	...	...	*Anemone Ludoviciana* flowering, its leaves not yet evolved. Mosquitoes first seen, and in a few days afterwards severely felt.—Sugar harvest commenced about 20th of April, and lasted till the 10th of May, showing the period during which the sap flowed freely in the sugar maple (*Negundo fraxinifolium*, De C.) The mean temperature of these two decades was + 36½° Fahr.; but it is to be remarked that the sugar boilers observe the flow of sap not to be so immediately influenced by a high mean temperature, as by the power of the direct rays of the sun. Most sap is collected when a smart frost during night is succeeded by a warm sun-shining day.
10.	...	+ 38.0	+ 46.2	+ 29.6	+ 67	
14.	...	...	...	...	...	Sugar maple and gooseberry bushes flowering.
17.	...	...	. .	...	...	Willows, gooseberries, and aspens (*Populus trepida*), in leaf. Various *Drabæ* in flower.
20.	...	+ 51.0	+ 60.4	+ 41.0	+ 84°	
25.	...	...	...	...	...	Pine Island Lake clear of ice.
28.	...	...	...	...	...	*Prunus virginiana*, *Prunus pennsylvanica*, and *Aronia ovalis*, flowering.
31.	+ 49.1°	+ 60.0	+ 76.0	+ 51.0	+ 80	The mean temperature of this month being only 49°, is nearly 3° below that which Baron Humboldt considered necessary for the evolution of deciduous leaves; but the influence of the direct rays of the sun was at this time very great, and the high temperature of the last decade of the month compensated for the defect of the first.

In the course of the month of May, ground was prepared at Cumberland House: and towards the end of it, barley sown, to be reaped again in August, after an interval of about 90 days, whose mean temperature may be stated at 67°.8. This latitude is therefore well adapted for the cultivation of barley and of spring wheat. Maize ripens readily here, although it frequently fails in the climate of Britain. At Edinburgh, for instance, in lat. 56°, where the mean temperature of the year is 47°.8, and there are five months that reach a mean of 51°.8, maize rarely ripens except in very favourable situations, and under the shelter and reflection of a wall, because the mean temperature of these warm days does not exceed 55°.8, or 12° below the summer temperature of Cumberland House.

The great plains on the Saskatchawan and Red Rivers, immediately to the north of the United States' boundary line, are extremely favourable to the cultivation of the Cerealia, the crops seldom suffering from late frosts or heavy rains, and at a future period may provide for a redundant population. At Carlton House, which is only sixty-six miles to the southward of Cumberland House, but where the sandy soil speedily feels the influence of the sun's rays, and where the presence of an icy lake, such as Pine Island Lake, does not moderate the spring heats, barley and wheat were sown in April, and by the middle of May the fields were green with the young blade.

These extensive plains are, however, at present subject to a great scourge,—a periodical visit of locusts or grasshoppers, at intervals of twenty years.

At Cumberland House there were 7 days in September 1819, 3 in April 1820, 16 in May, the whole of June and July, and 27 days in August, which exceeded 51°.8 of mean temperature: making in all 114, the sum of whose mean temperature is 7584, which give a general mean of 66°.53, as in Table V.

The largest pine-trees and balsam-poplars (*pinus alba* and *populus balsamifera*) were between eight and nine feet in circumference. The Saskatchawan River, or lat. 54°, and perhaps the isothermal line of 32°, is the most northerly limit, in the longitude of Cumberland House of the sugar-maple, (*Negundo fraxinifolium,*) elm, and ash, (species unknown,) hazel, (*Corylus Americana,*) and arbor-vitæ tree, (*Thuya occidentalis.*) At Carlton House, the maple goes to about fifty miles north of the river, so as nearly to reach the latitude of Cumberland House. Oak and beech (species unknown) terminate about 4° to the southward in lat. 50°, within the limits of the Red River Colony. The mean annual temperature of that colony cannot be much wide of +38° Fahrenheit; but the mean temperature of the three summer months may perhaps rise to 72°, a degree of heat sufficient for ripening the vine, if the shortness of its duration and the severity of the winter do not preclude the cultivation of that plant. The natural families of *Polemoniaceæ* and *Lineæ* seem also to have their northern limit at lat. 54° in these longitudes, a solitary species of each being found on the banks of the Saskatchawan. The *Cisteæ*, *Geraniaceæ*, *Rhamneæ*, *Umbelliferæ*, *Araliæ*, *Apocineæ*, *Valerianeæ*, *Hydrophylleæ*, *Chenopodeæ*, *Santaleæ*, *Urticeæ*, *Aroideæ*, and *Asparageæ*, send some straggling species a few degrees farther north, on a rude estimate not passing beyond the isothermal line of +27°.

It will be seen by an inspection of Table I., that, in the year 1819–20, the month whose mean temperature, at Cumberland House, approached

nearest to the mean of the year, was April; but perhaps the mean of observations, continued for a series of years, might point out the month of October as approaching more nearly to the mean of the year. Baron Humboldt observes, that this last month coincides generally within a degree of that of the year on the isothermal line of + 35.6° Fahrenheit. The mean of the spring and autumn temperatures at Cumberland House, + 32.4°, coincides very nearly with the annual mean; and the same thing occurred at Fort Enterprise, and also at Melville Island, within the fraction of a degree. At Igloolik and Winter Island, the climate being more of a maritime nature, the coincidence was not so exact. Melville Island, lying directly north of the centre of the Continent, must be warmed in the summer by occasional southerly breezes, which may account for its greater proportional summer temperature, when compared with Igloolik and Winter Island.

The mean temperatures for the last ten days of October at Cumberland House, and for the last ten days of April at Fort Enterprise, correspond very nearly with the mean annual temperatures at the respective places. Baron Humboldt remarks, that "it is an object of importance for travellers, whose observations are necessarily limited as to time, to know the ratios that exist between the temperatures of certain portions of the year, and the mean annual temperature;" and although observations for a single year, in high latitudes, are not to be depended upon, yet they may form the groundwork for future correction or verification; and we trust that the expeditions of Parry and Franklin will supply much that is wanting.

On comparing the seasons at Cumberland House with the seasons found on different isothermal lines in Europe, as laid down by Baron Humboldt, we find that the winter of Cumberland House, in Lat. 54°, and isothermal line of + 32°, is colder than that of Enontekies, in Lat. 68°, on the isothermal line of + 27°; that the *isocheimal line*, or line of equal winters, at Cumberland House —4°.6 passes to the north of Europe, being much colder than that of the North Cape in Lat. 71°, which has a maritime climate, and 4° below that of Enontekies, which has a more interior climate, and higher elevation above the sea. The *isothæral* line, or line of equal summer-heats, which in this instance is + 67.8°, on the contrary, when carried across the Atlantic, diverges to the southward nearly three degrees of latitude, passing to the southward of London, Brussels, and Paris, which lie in the isothermal band of from 50° to 52°. In more interior continental situations, however, the isothæral line again curves to the north, passing to the north of Warsaw in lat. 52.25°, on the isothermal line of + 49°, and to the south of Moscow, in lat. 55.75°, and on the isothermal line of + 40. In the interior of Siberia, the severity of the winter being great, it is more than probable that an entirely similar climate may be found. Humboldt, in one of his tables, has assigned the mean summer heat of Cumberland House to Central Russia, in lat. 58° 30′, and long. 36° 20′ E., and to Canada, in lat. 47°, long. 71° W., on the isothermal line of 41. The low summer-heat here assigned to long. 71°, in Canada, may be ascribed to its much more maritime climate, when compared to the interior situation of Cumberland House. The differences of these climates may be rendered more manifest by the following tabular view.

TABLE VII. *Difference of Summer and Winter on the Isothermal Line of* + 32°.

Situation.	Winter.	Summer.	Difference.
Cisatlantic Region, Long. 1° W. and 17° E.	+14.0° Fah.	+53.6°	39.6°
Transatlantic Region, Long. 58° W.—72° W.	+ 1.4 —	+55.4	54.0
Cumberland House (*Continental*) 102½ W.	— 4.6 —	+67.8	72.4

The effects of the Cumberland House climate, which may be considered as a perfect specimen of the *interior continental climate*, seems to be, as Baron Humboldt has somewhere remarked, that, after a long and severe winter, there is generated a great degree of irritability, both in animals and vegetables, which renders them more susceptible of the succeeding summer-heats. It may be, that it is this excess, as it were, of irritability, that renders the puncture of the mosquito so much more distressing at Hudson's Bay than in any other part of the world, and not the more poisonous nature of the insect itself.

The following *Cree names of the months* are indicative of certain natural phenomena, which recur with the returning seasons.

March,	*Meegeshew-cepæshim*,	Eagle-moon.
April,	*Neesca-'pæshim*,	Goose-moon.
May,	*Athock-cepæshim*,	Frog-moon.
June,	*Opuskow-cepæshim*,	Hatching-moon.
July,	*Opeeneyoo-cepæshim*	Moulting-moon.
July, August,	*Opahow-cepæshim*,	Flying-moon.
August, September,	*Attechtch-cepæshim*,	Ripe-berry-moon.
September, October,	*Tawkquaggan-cepæshim*,	Fall-moon (Fall of the leaf).
October, November,	*Onotcheehtow-cepæshim*,	Rutting-moon (of moose-deer).
November, December,	*Weetheekopeyoo-cepæshim*,	Hoar-frost-moon.
December, January,	*Keesheh-pawattagganum*,	The great-dreaming moon, the moon in which the sun travels low.
January, February,	*Keesheh-pawattagganawascc*,	Lesser-dreaming-moon.

The February moon, including part of March, is sometimes termed *Keesheh 'peeshim*, or Great Moon. The names of the months are by no means fixed in the Indian languages, varying with the nature of the district the hunter resides in, and perhaps with the fancy of the individual who speaks.

Remarks upon the Climate of Athabasca and Slave Lakes.

Having discussed as many facts respecting the Cumberland House climate as we could collect, I shall, before proceeding to details regarding the climate of Fort Enterprise, notice some circumstances connected with two in-

termediate spots, namely, Fort Chepewyan, on the Athabasca Lake, in lat. 58° 43′ N., and long. 111° 18′ W., and the Little Lake, near the *debouche* of Slave River into Slave Lake, in lat. 61° 12′ N., long. 113° 12′ W., because, at the former, barley, and I believe wheat, are advantageously cultivated, and the latter is the most northerly fur-post, at which, as far as my information goes, barley has been tried, and succeeded. We possess no observations of the temperatures of these districts for an entire year; but the summer temperatures of 1820 were obtained whilst we were travelling through them, and agree sufficiently near with the following interpolations; from which, however, the chilling effect of the icy covering of both lakes, in spring, is excluded.

TABLE VIII. *Interpolated from* TABLE II.

SEASONS.	Athabasca, Lat. 58¼ N. Long. 111½ W.	Slave Lake, Lat. 61½ N. Long. 113½ W.
Six summer months. April—September,	+ 47°.33	+ 43°.24
Six winter months. October—March,	— 0 .40	— 4 .14
Spring. March, April, and May,	+ 20 .61	+ 15 .52
Summer. June, July, August,	+ 60 .16	+ 57 . 0
Autumn. September, October, November,	+ 26 .87	+ 23 .59
Winter. December, January, February,	— 13 .36	— 18 .00
Mean annual temperature,	+ 23°.56	+ 19°.53

TABLE IX. *Interpolated from* TABLE I.

SITUATION.	MEAN TEMPERATURES.			
	May.	June.	July.	Aug.
Athabasca, Lat, 58¼ N.	41°.0	53°.6	62°.0	64°.5
Slave Lake, 61½ N.	37 .2	50 .6	60 .5	60 .4

These Tables show, that, at Athabasca, there are three months which reach 51°.8, and that their united mean temperatures amount to 180°. At Slave Lake, there are only two months that attain that height; and the sum of their mean temperatures is 120°. At Slave Lake, in the year 1822, it was nearly the end of May before the mean temperature of any considerable number of days reached the vernal temperature of 42°.8. On the 25th of that month, Slave River broke up, the passage of the lake over the ice being at that time considered unsafe. From the 25th of May to the 2d of June, we observed, on the voyage to Fort Chepewyan, willows, gooseberries, the *Anemone Nuttalliana* (D.C.), *Aronia ovalis*, *Prunus Virginiana*, and *Hippophäe Canadensis*, flowering nearly in the order in which they are here mentioned. The leaves were also rapidly evolving at this period, in perfect accordance with Humboldt's observations as to the temperature required.

The *Prunus Virginiana* was not observed to the north of Slave Lake;

and the *Pinus balsamea* also terminates there; although, farther to the westward, on Mackenzie's River, it is said to attain a higher latitude. The *Populus balsamifera* sends straggling trees as far north as lat. 63°; and the *Populus trepida* grew in pretty large clumps half a degree farther north, beyond which, however, it was not seen. The *Populus balsamifera* forms a large proportion of the drift-timber observed on the shores of that part of the Arctic Sea which we visited, and is supposed to come principally from the south branch of Mackenzie's River, named also *Rivière aux Liards*.

Remarks upon the Climate of Fort Enterprise.

Fort Enterprise (now dismantled) stood in a district of primitive rocks, about 2¼° north of Slave Lake, and 3¼° south of the Arctic Sea, above which it was supposed to be elevated about 800 feet. The banks of Winter River, upon which it was built, are ornamented with groves of the *white spruce-tree*, (*Pinus alba*,) and flanked on each side by an irregular marshy plain, varying in breadth from one to three or four miles, somewhat broken by abrupt elevations of coarse gravel, and bounded by an amphitheatre of disconnected hills. The summits of these hills generally consist of naked, smooth, rounded masses of *gneiss*: their sides are very thinly covered with a loose gravelly soil, and frequently exhibit accumulations of large cubical fragments of gneiss, which are the *debris* of mural precipices of various heights. In the upper parts of the inclined valleys, at the bases of the hills, there is commonly a thin stratum of mountain peat, but the bottom of almost every valley is occupied by a lake. Many of these lakes are of a considerable depth, but a large proportion of them are entirely land-locked, communicating with each other only when flooded by the melted snow. Winter River is merely a succession of small rapids, connecting lakes of various magnitude with each other. This is the case with all the rivers that traverse the *barren grounds*; and the features of the description here given are characteristic of the whole district. The sides of the hills, and all the dryer spots of the valleys, are clothed with a beautiful carpet of the lichens, which form the favourite food of the rein-deer, amongst which the *Cenomyce rangiferina*, *Cetraria nivalis* and *cucullata*, and *Cornicularia ochroleuca*, are predominant. The principal shrubs are the *Vaccinium uliginosum*, *Empetrum nigrum*, *Ledum palustre*, *Betula glandulosa*, and several *Salices*. The *Vaccinium vitis Idæa*, *Arbutus Uva Ursi* and *alpina*, are very common, and the *Andromeda polifolia*, and *Kalmia glauca*, occur in almost every peaty spot. In sheltered situations, where the peat is deeper than usual, there are frequently a few starved *larches* and *black spruces* scattered. There are also some thin clumps of the *Betula papyracea*, upon the borders of the rapids. The *white spruce* itself, which thrives better here than any other tree, is found only in sandy spots by the side of the river, or in valleys upon the borders of the lakes. Farther to the eastward, and more within the *barren grounds*, the trees disappear altogether; but a little to the westward, upon the secondary and transition strata of the Coppermine River, the white spruce, in scattered clumps, attains the lat. of 67° 34′ N., within 13 miles of the Arctic Sea. Amongst the spruces cut down at Fort Enterprise, one of

16	inches in circumference, had	45	annual rings,
18	ditto,	90	ditto,
21	ditto,	90	ditto,
36	ditto,	130	ditto;

the greatest increase being an inch of circumference in three years, and the least an inch in five years. The average is four rings or years, to an increase of 1 inch in circumference, or about 1 inch of diameter in twelve years; the tree above mentioned, which measured 36 inches, was one of the best grown that was observed; but some, with short crooked trunks, measured more. Our house was 24 feet wide; and considerable difficulty was experienced in obtaining half a dozen transverse beams long enough to support the roof, most of the trees tapering too much. The spruces seen near the mouth of the Coppermine, were about one-third of the size of those which grew at Fort Enterprise. In a few sheltered alluvial spots on the barren grounds, the *Betula glandulosa* was about 4 feet high, and in a warm crevice at the mouth of Hood's River, lat. 67½°, the *Alnus glutinosa* was found growing to the height of 5 or 6 feet.

Names of the Months in the Copper Indian Language, adapted to the meridian of Fort Enterprise.

1.	March, April,	*Det-anee-chazah.* Eagle-moon.
2.	April,	*Bennee-thleeng-thillah.* Dog-rump Moon. The month in which deer are run down with a dog, owing to a crust having formed upon the ice, sufficiently strong to bear a dog, but through which the deer break, and are impeded. Termed also Crust-moon.
	April, May,	*Khtunsee-hamzing-nawræ-zelleh.* The month in which the icicles with crooked tips hang from the rocks.
3.	May, June,	*Bennee-akkawzæ.* Egg-moon. Laying-moon.
4.	July,	*Bennee-atchithæh.* Moulting-moon.
5.	August,	*Bennee assitzillæh.* The month in which the female rein-deer pass during the dewy nights with their young from the coast.
6.	September,	*Bennee-arasseetcho.* The moon in which the large or male rein-deer arrive from the coast.
7.	October,	*Bennee-awrhawnteh.* Rutting-moon.
8.	November,	*Bennee-tsee-ch' ellyee.* The moon in which the fœtus floats.
9.	November, December,	*Nea-ts-tsaillah.* Hoar-frost-moon. Trees covered with festoons of snow.
10.	January,	*Nee-tsa-tchoh.* The big moon of the earth. The long moon. Half the winter.
11.	January, February,	*Nintzee-za-tsillah.* The moon of light winds.
12.	February, March,	*Nintee-za-tchoh.* Big windy moon.

TABLE. X. *Tabular View of the Progress of Spring in the year* 1821 *at Fort Enterprise, Lat.* 64° 28′ *N., Long.* 116° 6′ *W.*

Date.	*Mean Temperatures.* Of preceding Month.	Of 10 preceding Days.	Of maximum for 10 Days.	Of minimum for 10 Days.	Highest temperature within 10 Days.	PHENOMENA.
1821.						Coloured spirit thermometer in the sun + 39°. In the shade + 6°
March 7.						+ 2 — 2
10.		—8.10	+ 2.10	—18.30	5	
20.		—23.55	—13.80	—33.30	—1	
26.						+ 46 + 5
31.	—11.73	—3.54	+ 8.73	—15.82	+ 24	+ 32 + 24
April 1.	...	...	...	...	...	+ 63 + 40
						Smart thaw all day. The snow at this time was nearly 3 feet deep on the lakes, and the ravines were nearly filled.
10.	...	+ 8.20	+ 18.70	—2.30	+ 40	Eagles seen. Rein-deer making a northerly movement. The fineness of the weather at this time induced the Indians to think that the spring and consequent migration of the deer towards the coast had commenced; but their hopes were deferred by the subsequent cold weather.
20.	...	—7.90	+ 3.20	—19.00	+ 21	Arctic hares copulating, and beginning to change their fur.
30.	+ 4.70	+13.80	+ 27.20	— 0.10	+ 45	
May 3.	...	...	...	...	...	Temperature in the shade + 42. Hawks first seen. Young in the nest of the cinereous crow (*Corvus Canadensis*). Down of the American hare becoming grey. Trees thawed. Sap beginning to flow.
5.	...	...	...	...	...	Twilight all night. Snow melted from the summits of the hills. Ptarmigan pairing. Temperature in the shade + 46.
7.	...	...	...	...	...	Large patches of ground on the sides of the hills visible, 7 weeks later than the same occurrence at Cumberland House, 10½ degrees more to the southward. Snow everywhere moist. Temperature in the shade + 41°.
8.	...	...	...	...	...	A house-fly seen.
9.	...	...	...	...	...	A merganser seen. Rein-deer migrating northwards, exactly a month later than the Indians had predicted, from the fine weather in April.

TABLE X.—*Continued.*

Date.	Mean Temperatures. Of preceding Month.	Of 10 preceding Days.	Of maximum for 10 Days.	Of minimum for 10 Days.	Highest temperature within 10 days.	PHENOMENA.
1821.						
May 10.	...	+ 31.75°	+ 42.90°	+ 20.40°	+ 52°	Two gulls seen. Berries of the *Vaccinium Vitis Idæa*, *Empetrum nigrum*, and *Arbutus alpina*, may now be gathered abundantly, having withstood the winter. The berries of the *Vaccinium uliginosum* are also very fine in flavour at present, but so ripe and tender, that they can scarcely be plucked without crushing beneath the finger. The ground is still frozen, but the snow thaws rapidly in the sunshine. Many of the *Musci* are beginning to sprout, and the *calyptræ* of some *Jungermaniæ* are already visible.
11.	...	...	...	...	...	Loons (*Colymbus glacialis*) arrived.
17.	...	...	...	...	...	Teals (*Anas crecca*) killed. Their crops were filled with insects which now swarm in the small rivers.
20.	...	+ 26.55	+ 37.20	+ 15.90	+ 52	The weather for ten days past has been disagreeably cold and blowing, but the arrival of the summer birds shows, that the fine weather has set in to the southward; and we were informed by the natives, that, on the northern shores of Great Slave Lake, only $2\frac{1}{2}^{0}$ to the southward, the snow was quite gone before the 10th of the month. A difference of nearly 10 days in the progress of spring was noticed in the following month, on advancing only 30 miles to the northward. The cold weather experienced at this period at Fort Enterprise, arose from northerly winds, caused, I suppose, by the heating of the earth, and consequently of the atmosphere to the southward. This cause of northerly winds terminated this year about the 20th of June, by the ground to the northward being cleared of snow, and getting rapidly heated. Up to this date, there was no external appearance of vegetation amongst the phenogamous plants except the gradual evolution of the willow catkins.

TABLE X.—*Continued.*

Date.	Mean Temperatures.				Highest temperature within 10 Days.	PHENOMENA.
	Of preceding Month.	Of 10 preceding Days.	Of maximum for 10 Days.	Of minimum for 10 Days.		
1821.						
May 21.	...	...	...	...	...	Geese arrived (*Anas Canadensis*, and *hyperborea*.) Tem. + 39°.
28.	...	...	...	...	...	Temp. in shade + 68°. Plovers seen (*Charadrius pluvialis*.) *Eriophorum* flowering.
31.	+ 31.60°	+ 36.50°	+ 48.27°	+ 24.73°	+ 68°	Snow nearly gone at Fort Enterprise, but on Point Lake half a degree farther north, and at the same elevation above the sea, scarcely begun to melt.
June 7.	...	...	...	...	...	On the 7th, in lat. 55°, about 32 miles directly north from Fort Enterprise, and about 150 feet of greater elevation, the snow had scarcely diminished, except on the sides and summits of the hills, which are all of small elevation. The first, or female band of reindeer passed lat. 65° at this time, their progress over the *barren grounds* being regulated by the uncovering of the lichens. When the thaw is farther advanced, the lichens become too tender and pulpy, and the deer resort to the swamps to feed upon the hay or grass, which, frozen up in the end of Autumn, retains its sap and nutritive qualities, on the snow first melting from around it in the spring. In a few days, however, the culms become dry, and the seeds are shed, the deer by that time having reached the sea-coast, where the sprouting *carices* form their food, but are not so fattening as the lichens.
8.	...	...	...	...	...	Sudden thaw at Point Lake, lat. 65° 10′. *Eriophorum* just bursting forth there. It flowered ten days earlier at Fort Enterprise.
						Note. The temperatures up to the 10th, are from the register kept at Fort Enterprise; the following observations were made on Point Lake, lat. 65–66°, N. long. 113–114° W.
10.	...	+ 41 55	+ 52 80	+ 20.30	+ 73	

TABLE X.—*Continued.*

Date.	Mean Temperatures.				Highest temperature within 10 Days.	PHENOMENA.
	Of preceding Month.	Of 10 preceding Days.	Of maximum for 10 Days.	Of minimum for 10 days.		
1821.						
June 12.	...	...	...	...	...	Thermometer at Point Lake rose to 78° in the shade. Hard rain. Small lakes broken up. Point Lake still covered with ice five feet thick. Robins, (*Turdus migratorius,*) Godwits, (*Limosa Fedoa,*) and ducks hatching. A species of marten arrived. It builds a nest on the rocky precipices of the barren grounds, similar to the nests of the house-marten in England.
14.	...	...	...	...	...	Temperature + 56°. Calm and fine weather. Snow melting fast. It lies at present only under the steep cliffs. The radiation of heat from the rocks that bound Point Lake is such, that the ice is perforated by large holes under every precipice. By these holes the water from the melted snow runs off. The diminution of ice on the lakes proceeds most rapidly on its under surface, from the contact of the warmer water. The *Salix desertorum* burst its catkins to-day.
15.	...	...	...	...	...	Temperature 60°. The streams that issue from the melting snow under the precipices and sides of the hills, are now pretty large, some of them scarcely fordable; and all the valleys are flooded. The *Arbutus alpina* began to flower to-day. All the small birds are hatching.
17.	...	...	...	...	...	Snow and sleet. Temperature 30° to 35°.
19.	...	...	...	...	...	Temperature 54°. Ice on the lake honey-combed from the action of the sun. *Anemone cuneifolia* in flower.
20.	...	+ 43.35°	+ 52.10°	+ 34.60°	+ 78°	
21.	...	...	...	...	...	*Midsummer-day.* Dwarf-birch (*Betula glanduloca*) opened its buds to-day. The last or male bands of deer have passed to the north, a few stragglers only remaining.
30.	+ 42.05°	+ 47.10	35.40	+ 41.25	+ 56	The ice on Point Lake much decayed and honey-combed.

TABLE X.—*Continued.*

Date.	*Mean Temperatures.* Of preceding Month.	Of 10 preceding Days.	Of maximum for 10 Days.	Of minimum for 10 Days.	Highest temperature within 10 Days.	PHENOMENA.
1821.						
July 4.	...	...	...	...	...	The ice on the larger lakes in lat. 66°, long. 114°, completely broken up. About the 18th or 19th of this month, the sea-ice at the mouth of the Coppermine River, in lat. 67° 45′, is supposed to have broken up. The *Dryas integrifolia*, *Stellaria Edwardsii*, and *Equisetum arvense*, flowered today. *Epilobium spicatum* sending up young shoots.
6.	...	...	...	...	...	In lat. 66° 30′ N. *Salix reticulata*, *Alnus glutinosa*, *Hippophae Canadensis*, *Andromeda tetragona*, *Draba* —, *Draba aizoides* and *alpina*, *Pyrola rotundifolia*, *Saxifraga cernua*, *nivalis*, *hirculus*, and *oppositifolia*, *Tofielda palustris*, *Phaca astragalina*, *Pedicularis Nelsonii*, *hirsuta*, and *Lapponica*, *Silene acaulis*, and various Willows and Carices were observed in flower today. The *Juniperus communis* grows in the hills here, but was not seen in flower.
Aug. 17.	...	...	...	...	...	In lat. 68° on the coast, we had a severe storm this day, which, with frosty weather and snow, continued for several days. The snow that fell at this time disappeared
Sept. 5.	...	...	...	...	...	again, but on the 5th of September a storm set in, which clothed all the barren grounds from lat. 65° to 68° with snow for the winter.
Oct. 9.	...	...	...	...	...	On the 9th of October, the party walked over the small lakes between Point Lake and Fort Enterprise, which they had crossed on the ice in the middle of the preceding June, being an interval of 116 days. The ground was this year covered with snow a month before the lakes froze over, so that the snow lay for nine months, and there were occasional snow-showers in the three summer months.

By examination of Table III. we perceive that the summer temperature of Fort Enterprise is found at Churchill, in latitude 59°; the neighbourhood of the ice which floats in Hudson's Bay until August, compensating, in this case, for a difference of 6½ degrees of latitude. The *isotheral line*, carried across to the Old Continent, passes near to Enontekies.

In no part of the barren grounds did we discover the ground to be perpetually frozen. The subsoil, however, at York-Factory is always frozen, a circumstance which is also to be attributed to the constant presence of ice in the Bay during the summer. The thaw at York, (latitude 57°) in September, was observed to penetrate three feet.

In latitude 65° the sap of the spruce-tree freezes early in October, and in a short time the wood becomes as hard as a stone, the chips produced by a highly tempered hatchet being similar to saw-dust. The hatchets are speedily broken in this employment, which renders the Indians anxious to find dead and dry trees for winter use; and to procure a constant supply of this kind of fuel, they occasionally set fire to a clump of trees, expecting to find their trunks fit for use in two or three years.

At Slave Lake, where our attention was directed to this subject, the sap of all the other trees, and of the juniper-bush and other shrubs, was observed to freeze equally with that of the white spruce. The power of the direct rays of the sun upon the trees, causes them to show signs of returning life before the earth acquires any warmth, and the ground about the roots of the larger trees is first cleared of snow, and thawed.

Having, in the preceding details of climate, mentioned the circumstances most likely to influence the distribution and growth of vegetables in the districts travelled through, I may remark, that the agency of man, so powerful in modifying the appearance of the vegetable kingdom in other quarters of the globe, is scarcely to be detected in these remote lands. Cultivation of the ground is entirely confined to a few small gardens at the fur-posts, and the utmost effect that can be ascribed to it, is the introduction of a few herbs from Canada and Europe, along with the *Cereala* and culinary vegetables. The majority of the introduced plants is perhaps comprised in the following brief list of the species, which were found only in the direct trading route; but several, even of these, may nevertheless be indigenous:—*Blitum capitatum, Veronica peregrina, Lycopus Virginicus, Hordeum jubatum, Myosotis lappula, Rumex acutus, Cerastium viscosum, Spergula nodosa, Euphrasia officinalis, Lepidium ruderale, Atriplex , Urtica gracilis.*

The only mode in which the arts and customs of the natives affect the vegetable kingdom, is by their setting fire, either accidentally or intentionally, to the forests. These fires, when they occur during summer in the woody district, spread rapidly through the dry moss, consuming the soil down to the rocks, and are only extinguished by heavy showers of rain. Several years elapse before anything grows in the district thus laid waste. The blackened and branchless trunks of the trees are in a season or two stripped of their bark, and bleached, if not sooner thrown down by the wind. The surface of the ground next acquires a little verdure from the *Funaria hygrometrica, Bryum pyriforme, Didymodon purpureum, Marchantia polymorpha* and *conica*, and some other *Musci* and *Hepaticæ*. By and by other vegetables take root, and in process of time the site of a pine-forest is occupied by dense thickets of slender as-

pens (*Populus trepida*). The growth of this tree, instead of a renewal of the pine-forest, may be attributed either to a change in the nature of the soil, perhaps by the introduction of a greater quantity of alkaline matter,—to its winged seeds favouring its dispersion, —or to both causes conjoined. The ashes of the poplar yield much more alkali than those of any of the pines do.

Fires frequently spread amongst the dry grass in the plains of Carlton House; but their principal effect there seems to be the production of finer pasture in the following season. They do not seem in general severe enough to destroy the roots of the grass, or to burn the soil. The migrations of the herds of the bison or buffalo, are much influenced by the extent and direction of these fires.

TABLE XI.—*Arrangement of Plants growing in the Hudson's Bay countries, and adjoining Lands, from* Lat. 53° N., *and to the eastward of* Long. 116° W.

CLASSES AND FAMILIES.	Total of Species.	Woody Region.	Barren Grounds.	Common to both districts.
CL. I. ACOTYLEDONES, -	302	96	138	68
ORD. I. FUNGI.				
Sphæria, -	2	2		
Hysterium,	1	1		
Agaricus, -	3		3	
Cantharellus,	1		1	
Lycoperdon,	2	1		1
Schizophyllum,	1	1		
Dædalia, -	1	1		
Polyporus,	5	5		
Hydnum, -	1	1		
Thelephora,	2	2		
Tremella,	2		1	1
Peziza, -	2	2		
Erinæum, -	1	1		
	24	17	5	2
II. LICHENES.				
Lepraria, -	2		1	1
Arthonia, -	1	1		
Spiloma, -	1	1		
Solorina, -	1		1	
Gyalecta, -	1		1	
Lecidea, -	24	10	12	2
Calicium, -	4	2		2
Gyrophora,	7		4	3
Opegrapha,	2	2		
Verrucaria,	2	2		
Endocarpon,	2		2	
Thelotrema,	1			1
Variolaria,	1		1	
Urceolaria,	1		1	
Lecanora, -	22	3	14	5
Parmelia, -	14	5	4	5
Borrera, -	3	1	1	1
Cetraria, -	7		4	3
Peltidea, -	2	1		1
Nephroma,	2	1		1
Evernia, -	1	1		
Dufourea, -	2		2	
Cenomyce, -	10		2	8
Cerania, -	1		1	
Stereocaulon,	1			1
Sphærophoron,	1		1	
LICHENES.				
Alectoria,	1			1
Ramalina,	2			2
Cornicularia,	6		6	
Usnea, -	3	1	1	1
Collema, -	2		2	
	130	31	61	38
III. ALGÆ.				
Oscillatoria,	1			1
Conferva,	2	1	1	
Ulva,	2		2	
Fucus,	7	1	6	
	12	2	9	1
IV. CHARACEÆ.				
Chara, -	1	1		
V. HEPATICÆ.				
Riccia, -	1	1		
Jungermannia,	13	3	10	
Marchantia,	2	1		1
	16	5	10	1
VI. MUSCI.				
Voitia, -	1		1	
Andræa, -	1		1	
Sphagnum,	2			2
Gymnostomum,	1		1	
Anictangium,	1			1
Tetraphis,	1	1		
Sphlachnum,	10	1	9	
Asplodon,	1		1	
Encalypta,	2			2
Weissia, -	1	1		
Grimmia,	3		2	1
Syntrichia, Barbula, Tortula,	4	1	2	1
Trichostomum,	1			1
Dicranum,	12	2	9	1
Fissidens, -	1			1
Didymodon,	1		1	
Orthotrichum,	7	2	2	3

Classes and Families.	Total of Species.	Woody Region.	Barren Grounds.	Common to both districts.
MUSCI.				
Bartramia,	3		3	
Webera,	3	1	2	
Funaria,	1	1		
Meessia,	1		1	
Timmia,	1		1	
Pohlia,	3		3	
Bryum,	5	1	2	2
Mnium,	5	3		2
Climacium,	1	1		
Neckera,	1	1		
Leskea,	1	1		
Hypnum,	17	12	3	2
Polytrichum,	9		7	2
	101	29	51	21
VII. FILICES.				
Polypodium,	2	2		
Woodsia,	2	2		
Athyrium,	1	1		
Nephrodium,	1			1
Pteris,	1	1		
Cryptogramma,	1	1		
	8	7		1
VIII. LYCOPODINEÆ.				
Lycopodium,	5	1	1	3
IX. EQUISETACEÆ.				
Equisetum,	6	1	1	1
CL. II. MONOCOTYLEDONES.	113	70	26	17
ORD. I. GRAMINEÆ.				
Hierochloe,	3	1	2	
Oryzopsis,	1	1		
Stipa,	2	2		
Aira,	1	1		
Trisetum,	1			1
Deschampsia,	1		1	
Dupontia,	1		1	
Pleuropogon,	2		2	
Elymus,	3	2	1	
Festuca,	3		2	1
Poa,	8	3	3	2
Beckmannia,	1	1		
Avena,	1	1		

Classes and Families.	Total of Species.	Woody Region.	Barren Grounds.	Common to both districts.
GRAMINEÆ.				
Bromus,	1			1
Hordeum,	1	1		
Calamagrostis,	3	2	1	
Agrostis,	1	1		
Colpodium,	1		1	
Phippsia,	1		1	
Alopecurus,	2	1	1	
	38	17	16	5
II. CYPERACEÆ.				
Eriophorum,	4	1	1	2
Scirpus,	4	3		1
Eleocharis,	1	1		
Kobresia,	1	1		
Carex,	24	17	5	2
	34	23	6	5
III. JUNCEÆ.				
Juncus,	8	4	2	2
Luzula,	3	1	1	1
	11	5	3	3
IV. MELANTHACEÆ.				
Tofieldia,	3		1	1
V. ASPARAGEÆ.				
Smilacina,	3	3		
VI. ASPHODELEÆ.				
Allium,	2	2		
VII. LILIACEÆ.				
Lilium,	1	1		
Uvularia,	1	1		
Zygadenus,	1	1		
	3	3		
VIII. IRIEÆ.				
Sisyrinchium,	1	1		
IX. ORCHIDEÆ.				
Habenaria,	5	5		
Neottia,	1			1
Corallorhiza,	1	1		
Calypso,	1	1		
Cypripedium,	3	3		
	11	10		1

CLASSES AND FAMILIES.	Total of Species.	Woody Region.	Barren Grounds.	Common to both districts.
X. AROIDEÆ.				
Calla,	1	1		
Lemna,	2	2		
Typha,	1	1		
	4	4		
XI. JUNCAGINEÆ.				
Triglochin,	2			2
XII. FLAVILES.				
Potamogeton,	1	1		2
CL. III. DICOTYLEDONES.	425	278	85	62
ORD. I. CONIFERÆ.				
Pinus,	5	4		1
Juniperus,	2	1		1
Thuya,	1	1		
	8	6		2
II. CORYALACEÆ.				
Corylus,	1		1	
III. SALICINÆ.				
Salix,	30	20	8	2
Populus,	2	2		
Alnus,	1			1
Betula,	3	2		1
Myrica,	1	1		
	37	25	8	4
IV. URTICEÆ.				
Urtica,	1	1		
V. ELEAGNI.				
Eleagnus,	1	1		
Hippophaë,	1			1
	2	1		1
VI. SANTALEÆ.				
Comandra,	2	2		
VII. POLYGONEÆ.				
Polygonum,	2	1		1
Rumex,	3	2		1
Oxyria,	1		1	
	6	3	1	2

CLASSES AND FAMILIES.	Total of Species.	Woody Region.	Barren Grounds.	Common to both districts.
VIII. CHENOPODEÆ.				
Blitum,	1	1		
Atriplex,	1	1		
	2	2		
IX. PLANTAGINEÆ.				
Plantago,	3	2	1	
X. PLUMBAGINEÆ.				
Statice,	1			1
XI. PRIMULACEÆ.				
Lysimachia,	1	1		
Primula,	4	3	1	
Androsace,	2		1	1
Dodecatheon,	1	1		
Trientalis,	1	1		
Glaux.	1			1
	10	6	2	2
XII. LENTIBULARIÆ.				
Utricularia,	1	1		
Pinguicula,	2	1		1
	3	2		1
XIII. LABIATÆ.				
Lycopus,	3	3		
Mentha,	1	1		
Stachys,	1	1		
Dracocephalum,	1	1		
Scutellaria,	1	1		
	7	7		
XIV. SCROPHULARINÆ.				
Euphrasia,	2	2		
Bartsia,	3	3		
Rhinanthus,	1	1		
Pedicularis,	10	3	6	1
Veronica,	1	1		
	17	10	6	1
XV. BORAGINEÆ.				
Myosotis,	1	1		
Lithospermum,	4	3		1
	5	4		1

CLASSES AND FAMILIES.	Total of species.	Woody Region.	Barren Grounds.	Common to both districts.
XVI. HYDROPHYLLEÆ.				
Eutoca,	1	1		
XVII. POLEMONIACEÆ.				
Phlox,	1	1		
XVIII. GENTIANEÆ.				
Swertia,	1	1		
Gentiana,	4	4		
Menyanthes,	1	1		
	6	6		
XIX. APOCINEÆ.				
Apocynum,	1	1		
XX. ERICINÆ.				
Kalmia,	1			1
Rhododendron,	1		1	
Menziesia,	1	1		
Azalea,	1			1
Andromeda,	4	1		3
Arbutus,	2			2
Ledum,	2	1		1
Empetrum,	1			1
	13	3	1	9
XXI. VACCINEÆ.				
Vaccinium,	5	3		2
Oxycoccos,	1			1
	6	3		3
XXII. MONOTROPEÆ.				
Pyrola,	5	3		2
XXIII. CAMPANULACEÆ.				
Campanula,	3	2	1	
XXIV. COMPOSITÆ.				
1. *Cichoraceæ.*				
Sonchus,	1	1		
Leontodon,	1			1
Troximon,	1	1		
Hieracium,	3	2	1	
Crepis,	1		1	
2. *Cinarocephalæ.*				
Saussuria,	1		1	
3. *Corymbiferæ.*				
Tanacetum,	1	1		
Artemisia,	8	5	2	1

CLASSES AND FAMILIES.	Total of species.	Woody Region.	Barren Grounds.	Common to both districts.
COMPOSITÆ.				
Antennaria,	3	2	1	
Erigeron,	6	5	1	
Tussilago,	4	2	1	1
Senecio,	6	5	1	
Cineraria,	6	2	3	1
Aster,	9	8	1	
Solidago,	9	9		
Arnica,	2	1		1
Grindelia,	1	1		
Chrysanthemum,	2		2	
Achillea,	2			2
	67	45	15	7
XXV. VALERIANEÆ.				
Valeriana,	2	2		
XXVI. RUBIACEÆ.				
Galium,	2	2		
XXVII. CAPRIFOLIACEÆ.				
Linnæa,	1	1		
Caprifolium,	1	1		
Xylosteum,	3	3		
Symphorium,	1	1		
Viburnum,	2	2		
Cornus,	2	2		
	10	10		
XXVIII. ARALIÆ.				
Aralia,	1	1		
XXIX. UMBELLIFERÆ.				
Cicuta,	2	2		
Smyrnium,	1	1		
Heracleum,	1	1		
	4	4		
XXX. HALORAGEÆ.				
Hippuris,	2	2		
Myriophyllum,	1	1		
	3	3		
XXXI. ONAGRARIÆ.				
Œnothera,	1	1		
Epilopium,	4	2	1	1
	5	3	1	1

CLASSES AND FAMILIES.	Total of Species.	Woody Region.	Barren Grounds.	Common to both districts.
XXXII. PAPILIONAC.				
Thermopsis,	1	1		
Lupinus,	1			1
Lathyrus,	1	1		
Pisum,	1			1
Vicia,	1	1		
Hedysarum,	3	2		1
Phaca,	2	1		1
Oxytropus,	6	3	3	
Astragalus,	6	5	1	
	22	14	4	4
XXXIII. ROSACEÆ.				
Sorbus,	1	1		
Aronia,	1	1		
Rosa,	1	1		
Rubus,	5	4		
Geum,	1	1		1
Sieversia,	3	2	1	
Potentilla,	13	9	3	1
Sibbaldia,	1	1		
Comarum,	1	1		
Dryas,	2	1		1
Prunus,	2	2		
Spiræa,	1	1		
	32	25	4	3
XXXIV. GROSSULAR.				
Ribes,	9	9		
XXXV. SAXIFRAGEÆ.				
Saxifraga,	16	4	6	6
Chrysosplenium,	1			1
Parnassia,	2		1	1
Adoxa,	1	1		
Mitella,	1	1		
Heuchera,	1	1		
	22	7	7	8
XXXVI. RHAMNEÆ.				
Rhamnus,	1	1		
XXXVII. ACERACEÆ.				
Acer,	1	1		
XXXVIII. GERANIAC.				
Geranium,	1	1		
XXXIX. LINEÆ.				
Linum,	1	1		
XL. CARYOPHYLLEÆ.				
Silene,	1		1	
Lychnis,	3	1	2	

CLASSES AND FAMILIES.	Total of Species.	Woody Regions.	Barren Grounds.	Common to both districts.
CARYOPHYLLEÆ.				
Spergula,	1	1		
Cerastium,	4	2	1	1
Arenaria,	8	3	5	
Stellaria,	7	4	2	1
	24	11	11	2
XLI. CISTEÆ.				
Hudsonia,	1	1		
XLII. VIOLACEÆ.				
Viola,	7	7		
XLIII. POLYGALEÆ.				
Polygala,	2	1		1
XLIV. CRUCIFERÆ.				
Nasturtium,	1	1		
Barbarea,	1	1		
Braya,	1		1	
Platypetalum,	2		2	
Eutrema,	1		1	
Turritis,	1	1		
Arabis,	5	4	1	
Parrya,	1		1	
Cardomine,	4	1	2	1
Vesicaria,	2	1	1	
Draba,	11	3	7	1
Cochlearia,	1		1	
Capsella,	1	1		
Sisymbrium,	3	2		1
Erysimum,	1	1		
Lepidium,	1	1		
	37	17	17	3
XLV. FUMARIÆ.				
Corydalis,	2	2		
XLVI. PAPAVERACEÆ.				
Papaver,	1		1	
XLVII. NYMPHÆAC.				
Nuphar,	1	1		
Sarracenia,	1	1		
	2	2		
XLVIII. RANUNCUL.				
Thalictrum,	1	1		
Anemone,	6	3	1	2
Ranunculus,	12	7	3	2
Caltha,	3	2	1	
Coptis,	1	1		
Aquilegia,	1	1		
Actæa,	1	1		
	25	16	5	4

Remarks upon Table XI.

The materials of the preceding Table are principally derived from the *Botanical Appendix* to Captain Franklin's *Narrative*, which has furnished upwards of 700 of the species. To these, 65 phænogamous plants have been added from Pursh, that were collected at Hudson's Bay by Tilden and others, and are preserved in the Sherardian and Banksian herbaria. The most northerly of Michaux's plants being collected to the southward of latitude 53°, do not enter into our list; and the plants collected by Nelson and Menzies on the North-west coast, being from countries to the westward of the Rocky Mountains, and for the most part too far to the south, are also excluded. Thirty-three species, however, of phænogamous plants, from Mr Brown's *Botanical Appendix* to Captain Parry's first voyage, have been added to the column headed "Barren Grounds," together with seven from the herbaria made in Captain Parry's second voyage, and a few from Mr Brown's *List of the Plants* collected by Captain Ross, making the entire list in the Table amount to 840 plants.

The collection of Captains Parry and Ross compensate for the loss of the summer collection of 1821, in Captain Franklin's journey.

The structure of the Table is too simple to require explanation. The Woody Districts extend from latitude 53½ or 54° to latitude 64° south, or nearly to Fort Enterprise. The Barren Grounds from latitude 64° to the most northerly parts visited, or to 74°. By adding the plants in the last column to those in either of the two preceding ones, the whole vegetation of that district, as far as detected, is found.

The phænogamous plants in the preceding Table stand thus:

Woody Region.	Barren Grounds.	Total.
427	190	538

there being 79 species common to the two districts.

Names of Families arranged in the order of the Numbers of their Species which inhabit the Woody District.	*Woody District, Lat 53½°—64°.*		*Barren Grounds, Lat. 64°—70°.*		*Lancaster Straits about Lat. 74°.*	
	No. of Species.	Prop. borne by a Family to all the Phænogamous Plants of the District.	No. of Species.	Prop. borne by a Family to all the Phænogamous Plants of the District.	No. of Species.	Prop. borne by a Family to all the Phænogamous Plants of the District.
PHANEROGAMÆ,	427		190		70	
DICOTYLEDONES,	340	1 : 1·26	147	1 : 1.29	50	1 : 1.4
MONOCOTYLEDONES,	87	1 : 4.79	43	1 : 4.37	20	1 : 3.50
Compositæ, . .	52	1 : 8.21	22	1 : 8.64	5	1 : 14.00
Salicineæ, . .	29	1 : 14.72	12	1 : 15.83	1	1 : 70.00
Rosaceæ, . .	28	1 : 15.26	7	1 : 27.14	4	1 : 17.50
Cyperaceæ, . .	28	1 : 15.25	11	1 : 17.27	4	1 : 17.50
Gramineæ, .	22	1 : 19.41	21	1 : 9.05	14	1 : 5.00
Cruciferæ, . .	20	1 : 21.35	20	1 : 9.50	11	1 : 6.36
Ranunculaceæ, .	20	1 : 21.35	9	1 : 21.11	5	1 : 14.00
Papilionaceæ, .	16	1 : 23.72	8	1 : 23.75	2	1 : 35.00
Saxifrageæ, . .	15	1 : 28.46	15	1 : 12.66	10	1 : 7.00
Caryophylleæ, .	13	1 : 32.84	13	1 : 14.61	6	1 : 11.66
Ericineæ, . .	12	1 : 35.58	10	1 : 19.00	1	1 : 70.00
Scrophularineæ, .	11	1 : 38.82	7	1 : 27.14	1	1 : 70.00
Orchideæ, . .	11	1 : 38.82	1	1 : 190.00	...	...
Caprifoliaceæ, .	10	1 : 42.70	...	...	...	...
Grossulariæ, .	9	1 : 47.44	...	...	...	...
Junceæ, . .	8	1 : 53.38	6	1 : 31.66	2	1 : 35.00
Primulaceæ, .	8	1 : 53.38	4	1 : 47.50	...	...
Coniferæ, . .	8	1 : 53·38	2	1 : 95.00	...	...
Labiatæ, . .	7	1 : 61.00	...	...	...	...
Violaceæ, . .	7	1 : 61.00	...	...	...	...
Vaccineæ, . .	6	1 : 71.16	3	1 : 63.33	...	...
Gentianeæ, . .	6	1 : 71.36	...	...	...	...
Polygoneæ, . .	5	1 : 85.40	3	1 : 63.33	2	1 : 35.00
Monotropeæ, .	5	1 : 185.40	2	1 : 95.00	...	...
Onagrariæ, .	4	1 : 106.75	2	1 : 95.00	...	...
Umbelliferæ, .	4	1 : 106.75	...	...	...	...
Aroideæ, . .	4	1 : 106.75	...	...	...	...
Lentibularieæ, .	3	1 : 143.33	1	1 : 190.00	...	...
Melantheæ, .	2	1 : 213.50	2	1 : 95.00	...	...
Juncagineæ, .	2	1 : 213.50	2	2 : 95.00	...	...
Plantagineæ, .	2	1 : 213.50	1	1 : 190.00	...	...
Campanulaceæ, .	2	1 : 213.50	1	1 : 190.00	1	1 : 70.00
Eleagni, . .	2	1 : 213.50	1	1 : 190.00		
Polygaleæ, . .	2	1 : 213.50	1	1 : 190.00		
Plumbagineæ, .	1	1 : 427.00	1	1 : 910.00		
Papaveraceæ, .	—	—	1	1 : 190.00	1	1 : 70.00

The following families, as well as those distinguished in the preceding list by blank spaces, in the column headed "Barren Ground," were not observed to extend beyond the wooded district.

7 families of two species,

Asphodeleæ	Santaleæ	Chenopodeæ
Valerianeæ	Rubiaceæ	Fumareæ
Nymphæaceæ		

And 13 families of one species,

Irideæ	Fluviales	Corylaceæ
Urticeæ	Hydrophylleæ	Polemoniaceæ
Apocineæ	Araliæ	Rhammeæ
Aceraceæ	Geraniaceæ	Lineæ
Cisteæ		

Table XII. is compiled from Table XI. The column headed "Lancaster Straits" is from *Mr Brown's Botanical Appendix to Captain Parry's First Voyage*, with the addition of two *Cruciferæ* and one of the *Caryophylleæ* from his *List of Captain Ross's Plants*.

TABLE XIII.—*Principal Families of Plants in the Three Districts, arranged in the order of the Number of their Species.*

Woody District.	*Barren Grounds.*	*Lancaster Straits.*
Compositæ	Compositæ	Gramineæ
Salicineæ	Gramineæ	Cruciferæ
Rosaceæ	Cruciferæ	Saxifrageæ
Cyperaceæ	Saxifrageæ	Caryophylleæ
Gramineæ	Caryophylleæ	Compositæ
Cruciferæ	Salicineæ	Cyperaceæ
Ranunculaceæ	Cyperaceæ	Ranunculaceæ
Papilionaceæ	Ericineæ	Rosaceæ
Saxifrageæ	Ranunculaceæ	Papilionaceæ
Caryophylleæ	Papilionaceæ	Juncæ
Ericineæ	Rosaceæ	Polygoneæ
Scrophularineæ	Scrophularineæ	Salicineæ
Juncæ	Juncæ	Scrophularineæ
Polygoneæ	Polygoneæ	Ericineæ

CHATHAM,
January 1, 1825.

CHAPTER II.

ON THE NATURAL HISTORY OF THE SALMON, AND ON THE SALMON-FISHERIES,

AS STATED IN THE "REPORT FROM THE SELECT COMMITTEE ON THE SALMON-FISHERIES OF THE UNITED KINGDOM, ORDERED BY THE HOUSE OF COMMONS TO BE PRINTED, 17TH JUNE 1824;"—WITH REMARKS.

THE attention of the country has long been directed to the Salmon-fisheries, in consequence of the numerous discussions which have taken place in our courts of law, respecting the rights of different proprietors, and the legality of certain engines or modes of fishing. In the river Tay, and its estuary, litigations on this subject were, at one period, carried to a very great extent; and the heritors having fishings in the river, succeeded in establishing the coble-net as the only legal engine of fishing in the estuary, and suppressing all fixed apparatus, such as stake-nets. Two years ago, these victorious upper heritors brought in a bill to the House of Commons, for the ostensible purpose of promoting the interest of the fisheries in the river; but the under heritors succeeded in convincing the House, that the end could not be gained by a change of a *few days* in close time, nor by the police regulations proposed; and the bill was thrown out. Last year, the attempt was renewed, to introduce a similar bill, and with no better success. The house, however, having the subject thus pressed upon their notice, and aware of its national importance, resolved to examine it in all its relations. A Committee was accordingly appointed, and the evidence taken constitutes the Report to which we now propose to direct the attention of our readers. With the exception of one witness, "Henry Home Drummond, Esq. a Member," all those examined are individuals actually engaged as salmon-fishers, and practically acquainted with the subject. Among these, some seem acquainted only with coble-net fishing; others appear equally well skilled in stake-net as in coble-net. There is a paper added to the Report, which was delivered in to the Committee by Sir Humphry Davy, on the Salmon-Fisheries, in which the principal statements are at variance with the testimony of those witnesses who are the most extensive salmon-fishers in the United Kingdom.

In order to enable our readers to perceive the evils which exist in our salmon-fishing practices, and the principles by which the Legislature should be guided in framing new regulations to remove them, we shall consider the facts brought to light, or established in this Report, relating to the habits of the fish; then inquire into the nature of the alleged grievances by which the fisheries are injured, and proceed to the consideration of the remedies proposed. Without quoting in every

instance the words of the witnesses, we shall refer to the number of the page of the Report. It would have been more convenient had the questions, with the answers, been numbered, as the references could have been made with greater distinctness.

HABITS OF THE FISH.

In the course of the examinations which are here recorded, the Committee seem to have been anxious to determine the different *species* of fish usually found in the salmon rivers, or captured in the nets. This is an object of considerable importance, with the view of regulating the size of the meshes of the nets.

I. SALMON.—All the witnesses are of the same opinion with regard to this species; but they differ greatly as to this question, "Whether the salmon of one river can be distinguished from those of another by any definite characters." Mr Halliday has "compared them in Ireland, England, and Scotland, many times," and says, "I cannot make out the distinction of one river's fish from that of another;" p. 87. Mr James Bell states, "I have a little guess; not altogether;" p. 22. J. Proudfoot considers the Tweed fish as smaller than those of the Tay, and those of the River Isla as smaller than those of the River Tay; but, when asked if upon meeting with an Isla fish and a Tay fish in the frith, he would know the one from the other, he replies, "No; I would not;" p. 25. On the other side of the question, Mr James Wilson, in reference to the North and South Esks at Montrose, declares, that "the species of salmon is quite different in these two rivers;" and adds, "One is a large coarse scaly fish, and the other is a smaller and a finer fish;" p. 14. Mr James Bell states, that the "Aberdeen fish is quite different from the Tay, different in the scale;" p. 28. Geo. Little, Esq. states, that the salmon in the Shannon "grow to a large size," and adds, "We have three fishings that fall all into one bay in Ireland, the Bush, the Bann, and the Foyle, and we can easily distinguish the fish of all the different rivers when we take them. The salmon in the Bush is a long-bodied round salmon, nearly as thick at the head as he is at the middle. The salmon that we kill at the Bann, is what I call a very neat-made fish, very broad at the shoulders, and the back fin tapering away towards the tail, and quite a different shaped fish from the Bush fish. The Foyle is a river that we seldom get any large salmon in;" p. 112.

A considerable degree of importance seems to be attached to this branch of the inquiry, with the view of determining the question, Whether the fish bred in a particular river always return to their birth-place, and to no other river. Sir Humphry Davy *assumes* that "salmon, and salmon-trout, belong, in fact, to the river in which they were spawned," and that "each variety of salmon or salmon-trout affects a particular river, and always returns to it;" p. 145. The other witnesses seem generally to entertain the same *opinion*. Mr Little has been *told* of evidence on this subject, p. 112; but no *facts* are communicated. Indeed, Mr Halliday *asserts*, that "they do not all come to the same river in which they were bred;" and as a *proof* of this, he states, "I found the different rivers vary from one year to another; but when one is protected and another unprotected, the unprotected river keeps up its quantity as well as the protected one;" p. 87. Judging from analogy, we should consider it probable, that, in the absence of deranging circumstances, the fish bred in a river would generally return to it; but not a few, under the influence of those feelings on which depend the peopling of the globe, would wander into other ri-

vers. And when we consider the *persecutions* from seals, grampuses, and sharks, to which salmon are exposed in the sea, in connexion with their social or *gregarious disposition*, it is impossible to avoid drawing the inference, that the *tribes* belonging to different rivers must be frequently *dispersed* and *mixed*, and have their future movements controlled by other circumstances than the localities of their birth. In point of fact, salmon, so far from belonging to the *rivers* in which they were *bred*, belong to the *sea*, the place of their *ordinary residence*, where they *grow* and *feed*. The ordinary laws of citizenship, therefore, are not applicable to salmon.

II. Grilse.—Sir H. Davy and Mr John Wilson consider this fish as a young salmon; other witnesses, as Messrs Little, Johnstone, and Halliday, entertain a different opinion, viewing it as *a distinct species*. They found this opinion of its claim to rank as a species, on the circumstances of its being found full of milt or of roe, and of its spawning and return to the sea as a *kelt* or spawned fish. But fish spawn long before they attain maturity; consequently, this test is of little value. But other proofs are offered. Mr Johnstone says, "The grilse is a much less fish in general; it is much smaller at the tail in proportion, and it has a much more swallow tail, much more forked: it is smaller at the head, sharper at the point of the nose, and generally the grilse is more bright in the scales than the salmon;" p. 38. Mr Halliday states, that "a grilse's tail is very much forked, like that of a swallow; a salmon's tail is not forked like that of a grilse, and the chowk fins (pectorals) of a grilse are much more blue in their colour than a salmon's; a grilse is much smaller at the head and immediately above the tail than a salmon is; it seems to be a different fish in shape every way; besides, it goes up full of spawn in the end of the year, and does not come down till the spring, when it is a kelt grilse, while the young salmon are coming up the rivers in numbers of at least fifty young salmon for every kelt grilse that returns to the sea;" p. 63. Mr Little, who entertains a similar opinion to the two preceding witnesses, states, that grilses enter rivers in June, seldom in May, p. 112, (confirmed by Mr Halliday, p. 53,) and adds, "We do not find in some rivers the same proportion of grilses as salmon as we do in others; for instance, at our fishing at the Foyle, it consists almost entirely of grilse;" p. 110. When they first appear in the rivers, they are from 1½ to 3 lb. in weight, "and they increase gradually every week during the time we kill them." At the end of the season, they weigh "8, 9, or 10 lb." He likewise states, "Our water keepers tell me that they very seldom see a *salmon and grilse breeding together*, but they have seen it occasionally, but not generally—very seldom;" p. 113. There can be little doubt, that the term *Grilse* is used in general to denote a young salmon, though the same epithet is probably bestowed upon a distinct species of the genus Salmo, with which it seems to be confounded.

III. Trout.—Sir H. Davy considers Salmon-peal, Sewen, and Bull-trout, as constituting one species, the Salmo Eriox of Linnæus, the most correct appellation of which is *Sea-trout*. The Salmo *Trutta* of Linnæus, however, has been *universally* regarded by British systematical writers as the common *Sea-trout*; and the Salmo Eriox is a very different species. The term *Eriox*, as first employed by Albertus Magnus in the thirteenth, and by Cuba in the fifteenth century, was considered by Artedi as referring to the common salmon! Linnæus afterwards employed the term as a trivial name to the "S. maculis cinereis, cauda ex-

tremo æquali" of Artedi, and the *Gray* of Willoughby and Ray. De Lacepede continues the term in its Linnæan sense; and, we may add, for the information of the learned chemist, that S. Trutta and S. Eriox are both well characterised species and natives of Great Britain. Let him count the rays of the gill-flap if he doubts. Mr Johnston says, "Although in some friths and rivers, where there are a great many salmon, there are also great numbers of trout; yet in others, where there are a great many salmon, there are very few trout;" p. 38. Mr Halliday states, "In the Annan I have known us get more sea-trouts in one day, than we shall get in the Tay in a whole year;" p. 64. Mr Little declares, "that the sea-trout are not found in all salmon rivers. We do not see anything like the Spey-trout, or like the trout that is caught in the Solway Frith, or like the trout that is caught in the Tweed, in any of our fishings in Ireland. They do not breed, nor are they to be seen there;" p. 111. Sir H. Davy states, that "the different habits of the salmon and sea-trout are well demonstrated in the Moy, near Ballena in Ireland," on which there is a large pile near the town, and which, below the fall, is joined by a considerable stream. "The salmon leap this fall; the sea-trout almost all spawn in the smaller stream, a few miles from the sea;" p. 144. There is some strange blunder here. Mr Little, the tenant of the fishings on the Moy, says, there are trout, "but not the trout called the Sea-trout;" and with regard to the *pile* or fall which obstructs the progress of the trout, and over which the salmon leap, he adds, "They can go over it at tide-time, without leaping: after the tide rises, they can go over it;" p. 134. He likewise observes, "A trout goes very far up the river to spawn."—"The smaller the fish is, they go the higher up into the little streams to deposit the spawn; but the trout in the Moy are quite a different kind of trout from what we call in Scotland the salmon or sea-trout;" p. 134.

IV. WHITLING.—Sir H. Davy considers this fish as a young salmon, and states, that they are "without *visible ova or spermatic secretion;* are found in salmon rivers, a mile or two from the sea, and which return to the sea, without attempting a farther migration;" p. 145. Mr Little, who knows this fish by different names in different rivers, as hirlings, whiteings, or finnocks, declares, "We never see such a fish in Ireland, in the rivers we are concerned with. In the rivers that run into the Solway Frith and in the Tweed, and in some other rivers, they are found; but in a great number of rivers they are not. They are only found in those rivers where they breed. There are a few in the river Tay, shaped, and headed, and tailed like a salmon. They are from 12 to 15 inches in length. Some of them will cut up red, but they are mostly white. We frequently do not find them in rivers where salmon are; there are many rivers where there are salmon, where no such fish are known; we see them going down *kelt* in the same way as we see a large salmon going down after spawning;" p. 110. Mr Halliday states, "that in Carlisle they call them whitings; in Annan hirlings; and in the north finnocks. I never saw any in the Tay; but I have taken 100 dozen in the Annan at one draught. It is about 12 inches long. The tail of the hirling is straighter than that of the salmon or grilse, and it is quite a short-headed fish; neither does the head of the hirling shoot like that of the salmon when he is going to spawn. The largest I ever saw was about $\frac{3}{4}$ths of a pound. My reasons for believing that they are not the young salmon, are, that when they go up the ri-

vers, they are as *full of spawn* for their size as the salmon is; and when they come down in the spring of the year kelts, we are getting the young salmon;" p. 63. Mr Johnstone agrees with the preceding witnesses, in asserting the ordinary presence of ova and spermatic secretion, and in considering this fish as a distinct species. "They are called hirlings on the Scotch side of the Solway; whitings on the English side; hirlings, whitings, or whitlings, at Berwick; whitelings in the Tay; and finnocks in the north of Scotland;" p. 37.

V. PAR.—Mr Little is the only witness who is questioned in reference to this fish. "I have seen them; but I consider them merely a fresh-water fish, or a species of fish by themselves, unconnected with our salmon-fisheries altogether;" p. 113.

It is probable, that some species of migratory trouts have not been noticed at all. The river fishers are better acquainted with the trouts than the frith fishers. But we return to the HABITS OF THE SALMON, as furnishing materials for regulating the legislative enactments of this kingdom.

Before entering upon this branch of the subject, it may be proper to state, that the present legal time for beginning the salmon-fishing varies in different rivers, from the 10th December (in the Tay) to the 12th March (in the Solway;) and that the fishing-season legally ends, according to the rivers, from the 12th August (Ireland generally) to the 4th December (in the Teign.) How far these terms are suitable or improper, will presently appear.

In the more important actions of the salmon, viz. migration and spawning, there is a *season* during which these are executed by the greatest number of individuals, occupying, however, a range of some months. But there are individuals, executing these operations irregularly, at other periods. Mr Little says, "There are some rivers in which you will get some good salmon all the year round;" p. 114. In the *spring months*, few fish enter rivers; they rapidly increase in numbers as the summer advances; and in autumn, again, they begin to decrease, leaving the winter months, as to the ascending migration, to constitute a dead season.

The *condition of rivers* in the spring influences the movements of the salmon. J. Proudfoot states, that, "in the spring of the year, the fish always occupy the north side of the Tay (*i. e.* the sunny side of the river.) The north side fishing kills far more fish than the south side;" p. 28. Mr Little states, that, in "the river Shannon, the salmon fishery is nearly over by the middle of May," p. 114; and that he does "not get many fish in the Foyle of any kind till the end of May;" p. 112. When the great differences existing between different rivers, in the quantity, temperature, and contents of their waters, are duly considered, we need not wonder at the influence these circumstances may exert on the motions of salmon; but if we make a difference in the *close season* between *one river and another*, we must, with equal propriety, establish a similar distinction between the *south side and the north side of every river.*

In rivers, during the early spring months, the fisheries are seldom productive: even Lord Gray's fishings on the sunny side of the Tay, according to J. Gillies, "taking the average from the 10th December till the end of January, will not, one season with another, pay the expenses, or little more. There are some very good fishings in the month of February; perhaps in the month of February there will be ten days of those fishings, and scarcely take one fish." The same witness adds, in reference to the kind of fish taken

at those periods in the Tay: "You will get *ten foul* fish till the middle of February for *one clean* one;" p. 139. As the season advances, the salmon appear in the shores, in the estuaries, and enter rivers in greater numbers. The stake-nets, in such places, according to Mr Halliday, "are seldom productive but in May, June, and July;" p. 68. "The fishings fall materially off about the middle of August, and to the end of it;" p. 69 and 84. "In September they catch almost nothing;" p. 84. These conditions vary much with the season. The salmon are most abundant in dry seasons on the shore, and in estuaries. In rivers, they abound most in wet seasons. Mr Halliday, on this subject, offers some very pertinent remarks: "Because the stake-nets take the salmon at that season of the year when they would not go into the rivers; the rivers are not in a state to receive them, they become so heated: the rivers likewise become so very small, and the water gets so hot at that season of the year, when salmon is most plentiful on the coasts of Scotland, that they will not enter the rivers, the rivers being then not in a fit state to receive them; it is by the stake-nets that the fish at that season of the year can be taken in the greatest quantity; it is at that time, too, that they are in the greatest perfection; very few would be taken except by the stake-nets; and if they were not so taken, they would generally be lost altogether; a great part of these fish that the stake-nets do take, are taken going out to sea; even in the friths and estuaries, the fish do not go far up in the warm months. In the course of my practice in the Tay, I have carefully observed the upper stake-nets in comparison with the lower: when the seasons were dry, the upper stake-nets took very few fish in comparison at a particular time of the year: in one season, when the season was very dry and warm, the fish in the neap-tides did not even approach the highest stake-net, namely, Seaside and Birkhill; when the spring-tides became high, the fish came up to these nets, and were taken; but when the tide fell off again, the nets on the lower parts of the frith, on Mr Dalgleish and Mr Maule's properties, caught a great deal more fish at that particular time of the tide, when the fish did not float up so high as the upper stake-nets;" p. 72. In conformity with this statement, J. Proudfoot declares, that, "in rainy seasons, in heavy speats, the upper fisheries (in the river) give more fish in proportion when the river is high than when it is little;" p. 26.

The fish which enter rivers in the spring and summer months, have roe, but in May, for example, it is very small. As the season advances, the roe and melt are found in a riper state, until the time of spawning; but in these respects there are individual differences. Now, since salmon enter rivers months before they be ready for spawning, Do they remain in the river until that period, or do they occasionally return to the sea? On this subject the Committee seem to have bestowed considerable attention. The opinions of the witnesses, however, are at variance. In reference to the fish on the shore and in estuaries, Mr Wilson declares, "I believe they all go up those rivers; they are upon the shore, and get up the river if they can;" p. 14. Several of the other witnesses give it as their opinion, that salmon, before the spawning season, enter the rivers, and return again to the sea, influenced by very different instincts from those of spawning. The following proofs are offered:

1. It is asserted that *salmon remaining a short time in fresh-water, become weak, and return to the sea to be recruited.* It is stated by some of

the witnesses, that salmon are fattest at a particular season. Mr Little says, "In the month of May, I consider they are as good and as perfect as at any season of the year. From the month of May, they are gradually growing worse till they begin to deposit their spawn in the month of November;" p. 114. Mr Wilson reckons "salmon is at its best at midsummer, and falls greatly off after about the middle of July;" p. 12. Mr Johnstone considers "May and June as the period of their greatest perfection;" but he adds, "there may be equal to three months' difference between the quality of fish;" p. 56. Mr Bell, on the other hand, declares, "that the fish is full as good on the 10th December in the Tay, as at any other time of the year;" and "the Tweed fish is good in August, that is their best season;" p. 21. Mr P. J. Proudfoot says, in reference to the Tay, "there is a great deal of good fish killed by the time we commence the season;" (on the 10th December,) p. 27. These opinions are of less value than those now to be stated respecting the relative qualities of sea and river fish. Mr Wilson decidedly declares, that there is no difference in the quality of salmon taken at different parts of the same river, or in the sea adjoining, during the proper season; p. 13. On the other hand, Mr Johnstone says, "the salmon caught in the sea, and nearest to the sea, are generally the richest." When they have been some days in the water, "they lose their bright colour,—their firm state; the fish gets longer in proportion to its thickness, and loses its weight." "If he is not *many days* in the water, if he is caught immediately out of the sea, I do not see he can be any worse;" p. 50. "A few weeks would make him a great deal worse;" p. 53. Mr Halliday states, that those that had been long in fresh water "were very much exhausted, quite changed in the colour, as if they had *hung in a smoky chimney* for some time; others were very *red* in the skin, by having been in the fresh water for some time." "When they are in the fresh waters, they turn as slippery as an eel;" p. 61. "The salmon becomes unsound after it has been detained in fresh water at any season;" p. 79. Mr Little not only states, "if he remains any length of time in a fresh river, he becomes worse," but even limits the period to a week or ten days; p. 126. This supposed deterioration in fresh water, we consider to be *visionary*, and for this reason, if it took place, how could the fish suffer under its influence for months, while exerting themselves in ascending to the spawning-ground, while in the protracted act of spawning, during their residence in the neighbourhood after parturition, and in their subsequent descent to the sea?

2. *Salmon remaining in fresh water have their gills covered and eaten by worms, which fall off upon their return to the sea.* Mr Johnstone declares, "They get infested with worms or maggots in the gills if they remain long in the fresh water, which I think would kill them in the end, if they did not go back to the sea to get clear of these worms or maggots;" p. 35. Mr Halliday says, of fish in a bad condition, "Some of those we took had their gills almost eaten through with maggot worms, by being so long up the river;" p. 61. Mr Little declares, "I have seen their gills *entirely eaten off them* by the worms in fresh water; at least the thin and red parts *entirely* eat away," (*i. e.* all their organs of respiration!) "I do not believe they are ever found in that state except in fresh water, and it is necessary for them to leave the fresh water to get clear of the vermin which fasten upon them while there;" p. 108. The worm referred to, is the *Lernæ salmonea* of Linnæus, the *Etomoda salmonea* of La-

marc. We still ask the question, If the fresh water be so very exhausting, and the attacks of the maggot so very troublesome and destructive, how can the spawning fish survive during their residence for months in a river? It is to be regretted that the season of the year, and the condition of the fish as to spawning, had not been determined, as, trusting to the declarations of experienced river fishers, we consider that these worms only appear on the *kelt fish*, or such as have spawned, and which are consequently on their return to the sea.

8. *Salmon are caught in the rivers and estuaries on their way out to sea.* In proof of this, Mr Halliday states, "I fished the Annan for many years; and there is one pool in particular, namely, the Sand Pool; although we had fished this pool quite clean of fish before the rain came, yet, whenever the rain did come on, we then continued fishing constantly, until the water rose so high that we could not manage it, and we got the salmon and grilses coming down the river all the time into the pool. Some of those we took coming down the water of Annan were what we call *Moffatmen*, a term used for exhausted fish which had been at the head of the water;" p. 61. But the fish may have come up the water to this pool; or, if they came down with the flood, they may have been kelts; their gills were infested with maggots. This is the only proof in the Report, of the descent of salmon in rivers before spawning, and it refers to a length of course from the sea not exceeding a salmon day's journey. The point in question can only be determined at *salmon leaps*. Do fish ever recross these before they have become kelts? The proof in the estuary and sea is still more defective. Mr Johnstone declares, "The fish seldom go against the tide;" p. 44. "They run backwards and forwards with the tide in all directions;" p. 45. Mr Halliday admits that it is common "for salmon to ebb and flow with the reflux of the tide;" p. 91. With these admissions, the two last witnesses consider the salmon taken in stake-nets, with an ebb court for taking fish with the ebb tide, were such as had been in the river or estuary, and were leaving it for the sea. But if the salmon were *inactive*, the motions of the ebb-tide would carry them into the nets, in the same manner as the flood-tide carried them past. The fish do not enter rivers until the water is in a state to receive them, and they are in a condition to enter. Hence, on the shore and in estuaries, when not inclined to migrate, the motions of the tide will control them, and the ebb-nets will, from their very nature, be most likely to secure them. Even in the driest seasons, when the fish were not entering the river, Mr Halliday states that the ebb-nets were most successful; p. 72. Could they be other fish than such as passed by with the flood?

If fresh waters be so exhausting to salmon, and promote the growth of parasitical maggots so rapidly, how comes it to pass that they ever leave the sea, unless for the necessary purposes of spawning? The three witnesses, who consider that salmon run out of rivers to get rid of the worms which infest their gills, have a similar hypothesis for explaining their leaving the sea. Mr Johnstone says, in reference to their visits to rivers, "One evident object is to get clear of the vermin termed the *sea-louse*, which infests them sometimes when in the sea, and which leaves them when they get into fresh water;" and he admits, that when the salmon are subject to this insect in the sea, they are in the highest condition; p. 35. In reference to the length of time the sea-louse remains upon fish after leaving the sea, he observes, "I do not think

it remains many days, for when they are in the fresh water we soon observe them to go off; they do not go off all at once, they go off by degrees;" p. 35. Mr Halliday says, "They visit rivers to clean themselves of the sea-louse, an insect that fastens to them in the sea, and with which they are infested when they come out of the ocean, but which dies in fresh water;" p. 61. Mr Little says, "It is instinct which induces them to return to the rivers, and, as I consider, for the purpose of getting rid of a vermin which gets upon them, called sea-lice;" p. 108. The animal here referred to, is the *Monoculus piscinus* of Linnæus, and the *Caligus curtus* (mixed probably with *C. productus*) of Müller, but usually confounded with the *Lernea salmonea* of Linnæus, by a blunder of Mr Pennant. This animal is common to the salmon, whiting, cod, and flounder. The three last do not enter rivers to escape from its attacks. The salmon, when *most infested by it*, is in the *fattest and healthiest condition;* but still, in order to have it removed, this fish, in the opinion of these witnesses, enters rivers, where it is certain of being exhausted in a week or ten days, and where it is in danger of having its organs of respiration entirely devoured by the entomoda or maggot. Another reason, assigned by the same witnesses, for salmon entering rivers, is, searching for *food*. Of this, however, no proof is offered. But, in reference to estuaries, Mr Halliday has taken a great many salmon, "with worms passing through them; such worms as are to be seen on the banks;" p. 61. "I have had thousands of them dissected, when I have seen small sea-fish in their stomachs;" p. 90.

At what season do salmon enter rivers for the purpose of spawning?—We have already seen, that the milt and roe make their appearance in a very obvious manner so early as the month of May; p. 35. Mr Johnstone states, "that some are getting full of spawn in July;" p. 56. In August, "the great proportion of them are getting full of roe and milt; they always get full as they get near spawning;" p. 40. Mr Wilson states, that "in August they get considerably advanced with spawn; and in the end of August and beginning of September they get very full of spawn;" p. 12. William Bell, in reference to the Tay, states, that eight or ten days before the fishing-season closes, they are "very full of roe;" p. 32. J. Proudfoot says, "I have seen the fish, particularly the female, beginning to get very large by the 25th August;" p. 27. In September and October they are so full of roe and milt as to be unmarketable. Mr Halliday says, "Last year, some of the fish sent from Montrose before the 10th October were seeded, and condemned in the London market as being unfit for use; and I have seen them frequently take them by the 1st October that I considered were very unwholesome and improper fish to be taken;" p. 83. Even in February and March last year (1824), in the North Esk, "I caught them upon the spawning-beds in the night-time;" p. 84. Mr Little declares, in August, September, and October, in general, they get large in the belly, and full of roe and milt; and he adds, that for the purpose of spawning, "they begin to ascend in the months of August and September, and continue to the end of the year;" p. 107. In January, February, and even March, some of the fish are unspawned. Mr Little states, that "last season my tenant commenced fishing at my fishery in the Nith on the 11th March. He then killed, as I am informed, upwards of 200 salmon, some of them positively not spawned;" p. 116.

Fish ready to spawn seem to enter the rivers directly, and in the friths to keep the depth of the stream; hence, neither shore stake-nets, nor estuary stake-nets, are successful in capturing *red fish*. Even Mr Bell, a witness obviously hostile to stake-nets, declares, in reference to the capture of red fish in the estuary, that "none" are caught; and qualifies his assertion by saying, "there may be one accidentally in a year or two;" p. 23. In ascending the river, Mr Halliday declares, "the fish run most in the morning and evening;" p. 86. The *general time* of spawning, according to all the witnesses, is during the months of November, December, and January, pp. 61–108; though stragglers may be found in March.

The *interruptions* which salmon at present experience in ascending rivers for the purpose of spawning, chiefly arise from *mill-dams*. The walls of these, in many cases, are built in so close a manner, that for months there will not be enough of water to permit any fish to ascend. It is only in very great floods that they can successfully overcome the barrier. *Noxious matter*, from tan-pits, the steeping of flax, and gas-washings, expel salmon from a river;—pp. 133–67. In reference to noxious matter, however, Mr Drummond makes an exception in favour of peat-moss floated into the Forth from Blair-Drummond:—"I believe it to be troublesome to the nets in fishing; but certainly there is nothing noxious in the nature of moss to the fish;"—p. 141.

Fish ready to spawn are sought after by poachers for the sake of the *roe*. Mr Little says, "It is potted. The gentlemen going to fish in the lakes of Cumberland, buy it for the purpose of using it as *bait* in fishing upon those lakes;" p. 119.

With regard to the *mode of spawning*, it is gratifying to peruse the testimony of *eye witnesses*. Mr Halliday, after having stated that "they generally spawn in the running water, at the foots of fords and the tops of fords, where the gravel is fine, and low down in the foot of pools, where the water begins to run, so as to assist the salmon in removing the gravel," (p. 60,) thus describes the process: "When they proceed to the shallow waters, which is generally in the morning, or at twilight in the evening, they play round the ground, two of them together. When they begin to make the furrow, they work up the gravel rather against the stream, as a salmon cannot work with his head down the stream, for the water going into his gills the wrong way drowns him; and when they have made a furrow, they go a little distance, the one to one side and the other to the other side of the furrow, and throw themselves on their sides when they come together, and, rubbing against each other, they shed their spawn both into the furrow at once."—"I have seen three pair upon a spawning-bed at a time in the Annan; I have stood and looked at them, both while making the furrow and laying the spawn."—"I have often taken a number of these kelts with the skin rubbed off below the jaws, just between the *chowk* fins, (pectorals,) almost the size of a half crown, with rubbing up the gravel, and making the holes for the spawn."—"A male fish's head is always larger in proportion to his size than a female's, and it begins to shoot smaller at the point;" p. 62. "The spawning-bed is easily known by the thrown-up gravel; when I took my foot off the hard gravel, and put it on the spawning-bed, it was quite soft;" p. 65. In reference to grilses, he adds, "They spawn the same as the salmon."—"I have frequently seen them spawning in the autumn;" p. 64. Mr Little speaks in an equally decided manner. "I have frequently

looked at the salmon spawning."—"When they begin their bed first, it is like one furrow; they make a furrow in the shallow part or current of the water, where they begin their spawn; and they continue working against the stream, until they have formed a bed of perhaps twelve feet by eight or ten," "for one pair of salmon."—"In the instance I was alluding to, when I saw these salmon first, the bed was very little; but it increased every day. I observed the salmon go very leisurely down the side of the bed, and go just round where they have thrown up the gravel, and come back to the same point next the stream: as soon as they came up to this place, they threw themselves on their sides, and worked one against the other, at the same time rubbing their noses against the gravel, till they came to the other corner of the bed, and then they fell leisurely round until they came to the same place again, at the top of the bed next the stream, where they went through the same process. They continued in this way for many days, working; and if it so happened that they were frightened, they would run away, and in a little time return to it again."—"It takes them some considerable time before they get all their spawn deposited—several days; and I have known them, when they have been frightened away, go and leave their spawning-beds, and begin at other places."—"The bed is covered as they go along."—"Both assist in it, and while in the act of depositing their spawn." He adds, that "the male gets a very long hard bill on his under jaw, which *decreases* as the spawning season passes;" p. 108. Sir H. Davy asserts, (but whether from having seen the operation, is not stated,) that "the female fish, in spawning, deposits her eggs slowly *on gravel;* the male sheds a white seminal liquid *upon them;* and both fish cover the eggs with gravel. The male is most active in this operation, which hardens the extremity of the mouth, and *bends it into the form of a hook*;" p. 145. The opinion here expressed, that the female first deposits her roe, and then the male sheds the milt upon them, stands contradicted by the preceding eye-witness; and, we may add, that it is not the extremity of the *mouth* or nose, but the extremity of the *lower jaw*, which is bent up; and were this bending produced by the resistance of the gravel in the act of covering up the spawn, then the lower jaw in males, before they had spawned, should be much longer than the upper, which the witness will find not to be the case; and the gravel, we should think, would be rather apt to enter the mouth. This bending is in a great measure characteristic of the male; but the peculiarities of its form and position demonstrate that it could not be produced by mechanical means.

The quantity of eggs deposited by a single female, has been variously stated by different authors. Mr Johnstone says, "I have counted them (eggs in the roe) repeatedly; they are from 18,000 to 20,000 on an average;" p. 36. Mr Halliday says, "They are not all exactly of the same number; I have found them of different numbers, from 17,000 to 20,000;" p. 62.

It may be proper here to inquire, whether, according to the present fishing season, the salmon are ever disturbed on their spawning beds? Alas! but too frequently. James Gillies declares, that, in reference to the year 1819 in the Tay, "we took eighteen at one haul, in the month of December, of fish spawning on the spawning-beds;" p. 138.

Leaving for a little the spawning-beds, let us attend to the character and motions of the spawned fish, or *kelts*, as they are termed. In this state, says Mr Wilson, "when the spawn is

just leaving the fish, it is merely just two pieces of skin, just like a cow in calf;" p. 13. Mr Johnstone adds, "By a kelt is meant a fish which has recently spawned; it is very thin; it gets very much discoloured; it is very long in comparison with its thickness; the head is very large; the fish is quite out of season; the fish then cuts white in general;" p. 37. Mr Wilson declares, from six or eight years' experience in the North Esk, in Forfarshire, the Dee and the Don, in Aberdeenshire, the Beauly and Lochy, in Inverness-shire—"in fact, fishing those fisheries before the 1st of February, you would catch nothing but black fish (kelts,)" p. 13. When the process of spawning is finished, according to Mr Halliday, "they go into a pool to *recruit* themselves (*recruiting* in fresh water, so *exhausting* to fish!) and, in about a fortnight or three weeks thereafter, then the *male* fish begins to seek his way down the river. The female fish remains longer about the spawning ground; and I have very often found some of the mother fish going down a kelt as late as when the first of the fry began to come down the river."—"In the end of April and beginning of May, I have taken five at one haul in the river Annan;" p. 62. He says, in February and March, "*immense numbers* are caught;" and "in the upper parts of the Tay, there must be thousands taken annually," p. 83. James Gillies has formerly stated the number of foul fish (kelts) in February. He adds, "You could not commence before the month of March, without taking the foul fish, because the most part of the *she fish* come down in the month of March from the high lands. You will see them go down in shoals. The *he fish* always seeks his way down immediately after he spawns; but you will scarcely get a *she kelt* early in the season. You will get the *she fish* coming down in the months of March and April, *great numbers* of them; and you will scarcely get one he fish so late as that month; all the *he's* are coming down chiefly in the month of February;" p. 139. Mr Johnstone declares, that the kelts "are found during the months of January, February, March, and April; and, I believe, some are found in May, but they get very scarce then," p. 36. Mr Little says, that, after spawning, "they remain a little time near the place, and then return again to the sea." With regard to the time they remain, he says, "that depends a good deal upon the season, whether it is a dry or a wet season: if it is dry weather, they remain longer; but if it is wet weather, they soon go down to the sea," p. 108.

In the course of their descent to the sea, they experience *interruptions* from cruives and dam-dikes; but, when arrived at the place where the tide meets the river, they seem to pursue the deepest part of the channel or stream, and escape all the coble-nets and stake-nets of the *estuaries* and *sea-shore*. In reference to the stake-nets capturing kelts, Mr Bell declares they do not, p. 29. Mr Johnstone says of the stake-nets, "very few were ever caught in them;" and gives as the reason, "the kelts in the river are in a much narrower compass, and so are more subject to capture: they are seeking their way down to the sea, and generally prefer deep water; the water on the banks on which the stake-nets stood was very shallow; and generally by the time the fish came down so far from the river, the banks were getting dry by the tide leaving them. When the fish meet the flowing tide, they generally stop, the current being strong; the surf or agitation of the water, in the shallow waters on the banks of the friths, must also keep a weak, unhealthy fish like a kelt, from venturing on the banks; when it has not strength like a sound

fish, the deep water is more suitable. I have often found them driven on shore dead, when they ventured on the banks; they were thus very seldom caught in the stake-nets, because they were seldom within reach; whereas in the river they had no means of escape;" p. 43. Mr Halliday, in reference to the stake-nets of the Tay, declares, "I have fished some seasons, and have not seen above two kelts the whole season in the stake-nets."—"I have not seen a single kelt in them all some seasons."—"Kelts do not generally resort to that particular part of the shore;" p. 69. Mr Shepherd declares, that, during his survey of the river fishing in 1809, during the stake-net process in the Tay, he has seen foul fish taken in April, in the river fishings, but in the stake-nets "never but one;" p. 102.

The station in the sea to which the kelts resort, yet remains to be discovered. Sir H. Davy says, "Salmon do not go far out to sea;" p. 145. How he has gained this information does not appear. Not surely from the proprietors of stake-nets on the sea-shore, for salmon seldom enter there, but from May to September;—not surely from cod and haddock fishers, for the bait which allures these fish tempts not the salmon. William Bell thinks that the fish that enter rivers from the sea "come from the north," (p. 33.); the very place, we may add, whence the older naturalists brought the herrings.

To return to the *spawning-bed*, we are compelled to record the injuries which it must sustain by the present practice of fishing. Mr Halliday, in reference to the coble-net (for the spawning-beds are remote from the stake-net grounds) as used in the winter and spring, says, "We have very strong ropes made of old nets, and with round circles of heavy rope lashed to the ground-rope of the net to keep it down; sometimes we tie stones to it to keep it to the bottom, and sometimes we put two cast-metal sinkers. It is generally in the spring that we require the heaviest weights at the bottom of the coble-nets, on account of the river being heavier or more full of water at that season. If thousands of fish should breed in the river, it would be impossible for spawn to come to perfection, where we are constantly fishing over them all the twenty-four hours with coble-nets."—"They usually fish the whole fords in the river from top to bottom at pleasure, with ground-ropes trailed along them;" p. 65. He has seen this process performed on the very places where "they use winches and capstans in the Tay; by which means they can add more weight to the bottom if they like." Though he never examined the river to determine whether the eggs were actually removed, yet he declares, "I have seen the under rope of the net level down the spawning-bed;" and he adds, with force, "You might just as soon have a bed of onions to come to perfection (as a spawning-bed,) if a coble-net and rope was dragged over it, tearing up the mould twenty times a-day; I would take my chance of the one as soon as the other;" p. 56.

The *period* when the spawn evolves the fry, is stated by Mr Little to be when the natural warmth comes into the water in the month of March; "and they continue going down from that time until the first of May: sometimes I have observed them going down till the month of June; I have seen some of them in the month of June, but they principally are out of the river early in May. The spawn does not come into life, I consider, till March;" p. 115. Even with regard to the time of the fish rising from the gravel, he says, "I have observed, when we have early warm weather, the fry come early; and when we have a late spring, it is later before the fry rise from the gravel; of course a great deal depends upon the season,

but generally they begin to rise about the beginning of March, and they end about the middle of April in rising from the bed;" p. 109. Mr Halliday says, "I think they generally come into life the end of March, or from about the middle of March to the end of it; but I do not think they come all into life exactly at one time, but nearly so. Some of the fry appear to be much larger than others, and I do not see the young fish so plentiful at the sides of the water at the first as after some time;" p. 52. Sir H. Davy says, "It is stated that the eggs produce young ones in about six weeks," p. 135;—an opinion rendered nugatory by viewing in connexion the general period of the spawning and the general period of the appearance of the fry.

There is very little satisfactory information respecting the appearance of the fry at the time of their evolution. Mr Little says, "I never saw them in that state, but I have often conversed with other water-keepers on the subject, who are placed upon the upper branch of the rivers, and they describe them very much in the same way that Mr Scott did when he was examined in the Tay case, that they rise from these gravel-beds like a crop of oats or thick braird of grain, rising up all round the stones in very great numbers. The tail comes up first, and they will come from these beds with a part of the pea about their heads;" p. 109. At such a period, the destruction occasioned by the heavy ground-rope of the coble-nets must be truly great.

The progress of the fry from their birth-place to the sea, is given in detail by several witnesses, all of whom agree in the particulars. The fry, freed from the spawn, and now termed *smouts* or smolts, betake themselves to pools, and afterwards proceed, according to circumstances, in myriads along the easy water at the margin of the river, with their heads against the stream, until they reach the frith where the tide ebbs and flows, where, like the kelts, which frequently go down at the same time, they retire to the deepest part of the channel, and disappear in the sea. These facts were established upon oath by two competent witnesses in the Tay case, and their evidence is recorded in the Report, p. 92. The flooded state of the river is most favourable for their descent, by supplying depths of water on the shallows or fords. Mr Little says, "The Coleraine or Bann is a late fishery: and, in the year 1820, in the spring of that year, I considered we lost nearly all the fry; the dry spring did not allow them to come down the small rivers; they were collected into little pools, and the people in the country destroyed them; and in the end of that season of 1820, the fishing fell off to 42 tons;" p. 127.

The smouts descend during the months of March, April, May, and June. Mr Halliday states, "From the first time that I have observed them, about the end of March or beginning of April, they come down until the 10th or 12th of May. I have seen them in the middle of May, and as late as June, in a particularly dry season, when the river had not been flooded;" p. 63. Mr Wilson says, "I think they commence going down about the end of April, and finish going down about May;" p. 10. James Sime, in his deposition in the Tay case, "believes that the fry goes down the river in the month of April;" p. 93. Mr Little declares, that "they are principally out of the river early in May;" p. 115. Mr Johnstone says, "They have generally reached the sea in the month of May. Some reach it in June —a few;" p. 36. While the fry are in the act of descending to the sea, they are exposed to many *enemies*, of which the following are the most destructive.

A. *Coble-nets.*—As these engines, according to the present practice, are in active operation during the period of the descent of the fry to the sea, we may expect such statements as the following. Mr Johnstone says, that smouts cannot pass through the coble-net, "if there be much dirt in it; and sometimes, particularly when there is a number of them, they get *broadside on*; in particular, when there is salmon in the net, they prevent the fry from going through so easily; and the net is loose and not extended, more especially when near the edge of the water;" p. 40. Mr Halliday says, "I have dragged a number of them on shore with the coble-nets." "I have dragged them ashore at the Howe's Pool, on the River Annan; in the Bridge Pool, at the Bridge of Annan, when the boys used to gather them up; and at the Old Mill Pool I have hauled out a good many;" p. 66.

B. *Angling.*—At first sight, one might suppose that the angler was an enemy of but feeble destructive powers. But it appears to be otherwise in fact. Mr Wilson says, "I have seen from my own window, upwards of seventy or eighty people angling within the distance of half a mile on the Tweed;" p. 15. Mr Halliday declares, "I have killed above twenty dozen with the rod in one day;" p. 62. Mr Little says, "I have killed twenty or thirty dozen of fry, when coming from the school at Annan to Newby, in half an hour, with a rod, in an afternoon," p. 121; and he adds, "I have known even boys and children go and kill, in the course of an afternoon, twenty, thirty, or forty dozen;" p. 132.

C. *Mill-races.*—Mr Johnstone says, "I have seen hundreds of them lying dead at the bottom of a mill-race, killed by the wheel."—"I have seen them in thousands and tens of thousands, in the water in the mill-leads, seeking to go down, but prevented by the dike across the river, which they could not get over;" p. 40–41. Mr Halliday states, "I have seen the miller taking out his creel in the morning at Newby mill, and taking baskets-full out of it; and I have seen great quantities lying dead in the dam behind the mill-wheel in the morning. I have also known the miller to put in a heck in the small side-sluce, by which means great quantities are destroyed in the night time, when they set the water off the wheel, through the side sluices. There have been so many taken on some of the mills on the Annan, that sometimes they have fed their pigs with them;" p. 67. The dam-dikes conduct the fry, when coming down the water, into the mill-dam; and when night comes on, they do not see, and they seek their way down the dam, and so they go into the miller's heck or basket, and are all taken;" p. 67. Mr Little adds, "They are very destructive to the fry when they come down the river; they take amazing quantities as the fry go down. In dry seasons, when the waters are little, there is no other way for the fry to get down the little rivers than by going down the mill-lead; in fact, they can take all the fry that there are in the river at those mills. I have seen the water black in these mill-leads with fry, seeking down to the sea." "I know they take the fry in Ireland, and cure them like herrings;" p. 118.

D. *Eel-weirs.*—Mr Little says, "In Ireland, the eel-fishery is very hurtful to the salmon-fisheries. The eels are caught by weirs, set in the river for taking the eels going down to the sea. The eel-weirs are made of stake and wicker work, drawn together towards the centre, and the net, which is like a bag, is hung at the centre. The proper season of the eel-fishery is in months of September, October, and November, *when the eels are going*

down to the sea to spawn; but those who have eel-weirs place their nets in the river at the time the salmon-fry are going down: they do this under the pretence of catching eels, but really to catch the salmon-fry, which they catch and salt in some places in great quantities;" p. 118.

It has been alleged that stake-nets in estuaries and on the sea-shore are destructive to the salmon-fry, and various questions are proposed by the committee, with the view of eliciting the truth. The answers and documents produced, however, demonstrate that there is not even a vestige of foundation for the charge. The meshes of the stake-nets are too large to detain a smout, as, according to Mr Halliday, they are "about three inches from knot to knot, or twelve inches in the square;" p. 70. It has, however, been supposed, that the meshes may be so closed up by floating weeds, as to enable them to interrupt the fry. But Mr Halliday, and other witnesses, declare, "If the sea-weed were to close the net, it would be broken down. I have had the stakes broken, and the nets thrown down by the sea-weed, when the meshes were not near fully closed by it." "I have seen where there was sea-weed left upon the net, that the tide would have taken away the very clay from the foot of the stakes two or three feet deep, and the salmon have frequently gone through below the net, and been lost when this has happened." "But we cleaned them every tide, or otherwise the sea would break them down; but it was very seldom they were closed; it was only at the bottom of the net, and at certain seasons of the year, when the summer's growth comes up out of the sea, about the month of July (not a smout month,) for a short period;" p. 70. On the supposition that the fry did frequent the stations of the stake-nets, these explanations would have been satisfactory. But the fry do not frequent the places where stake-nets can be erected. In reference to the Tay, Mr Johnstone declares, that he "never" saw a smout in a stake-net; p. 43. Of the presence of such in stake-nets, Mr Halliday also says, "never; and they could not be there without being seen by me; it was impossible;" p. 70. Mr Little declares, "A stake-net neither injures the breeding fish, nor does it destroy the spawn of the salmon or the fry: I speak from having attended those nets, and never having seen any salmon-fry in them;" p. 122. Mr Sime and Shepherd, who surveyed the stake-nets on purpose, during the "Tay case," never found in any of them any salmon-fry; p. 92, 93. They are not even taken by the spirlin-nets, which have a small mesh. In fact, not only are the stake-nets innocent of the charge of catching the fry, but even the coble-net in the estuary can do them no harm, as they are beyond its reach in the deep water. Hence Mr Sime and Mr Shepherd, though fishing with a small meshed net *on purpose, both* in the eddy water and in the stream, found none after the fry had reached the tide, *ib.*

The period of the return of the fry from the sea, seems not well determined; and on this interesting subject the evidence is very imperfect. Mr Wilson seems to think that, as grilse, "they return again at the end of June and the commencement of July."—"Perhaps from the end of June they will average three pounds, and at the end of July about four or five pounds;" p. 10. Mr Halliday says, "I think we do not see them again from the time they leave the river as fry, until the next year, early in the spring, when they begin to return to the rivers young salmon;" p. 87. Mr Little says, "I consider that what we call

the fry that go down in the early part of the season, if they are allowed to go down to the sea, they return the same year; and that we kill them from three to nine or ten pounds weight;" p. 111.

The witnesses seem generally to agree with the prevailing opinion, "*That the salmon fisheries in the kingdom are rapidly decreasing in value, owing to the increasing scarcity of fish.*" But the importance which should be attached to this evidence, will be estimated differently according to the judgment of the reader. Mr Wilson communicates a statement of the number of boxes of fish shipped from the Tweed, or rather for the first thirteen miles from its mouth, from the year 1796 to 1823. In this table we perceive the very great fluctuations of the fisheries, *depending on the seasons;* the years 1796 and 1815 were as 9.338 to 9.382 boxes; yet 1776 was to 1797 as 9.338 to 12.665 boxes; and 1815 was to 1816 as 9.382 to 11.471. The year 1803 is less than 1819, and 1809 than 1819 or 1821, and but little higher than 1822 or 1823. The box of salmon previous to 1816, contained 6½ stones of fish, since that period it contains 8 and 12 stones. In this table the consumpt of the neighbourhood, or what is sent to a distance by carriers and coaches, is not noticed. Hence the table is useless as an index of the actual productiveness of the Tweed, though it may serve to illustrate the character of the exports of Berwick. Mr Bell says, that in all parts of the Tay, the fisheries have decreased, but no statement is produced, p. 20. J. Proudfoot says, "In 1815, 1816, 1817, and 1818, it was a tolerable fishery, and the year 1819 was rather inferior with me; perhaps it might not be less with some; and since 1820, we have had regular bad years successively." But in reference to the influence of the seasons in producing these changes, he says, "For the last two years they have not been so good," p. 26. In reference to the fishery in 1824, of May, compared with the corresponding period in 1823, he says, "I believe that this season there is more fish caught in the Tay, as yet, than last season," p. 33. There is a statement given by Mr Little, of the relative produce of his Irish fisheries, from the year 1808 to 1823: we shall give a few examples of intervals of ten years. The produce in tons of fish was at the Bann in 1808 and 1818, as 76 to 70; in 1809 to 1819, as 80 to 82; in 1812 to 1822, as 65 to 31; in 1813 to 1823, as 47 to 52. In the Bush fishery, 1808 is to 1818, as 16 to 12; 1809 to 1819, as 9 to 12; in 1812 to 1822, as 8 to 8; and in 1813 to 1823, as 7 to 14: in the Foyle, 1808 is to 1818 as 37 to 44; 1809 to 1819 as 36 to 58; 1812 to 1822, as 48 to 57; 1813 to 1823, as 35 to 50.—*Evidence*, p. 106. The statements, then, which have been adduced, as exhibiting the increasing scarcity of salmon, may be regarded as entire failures, nor shall we find, that the *causes assigned* constitute any better proof. These may be reduced to the following.

1. *Poaching.*—The quantity of fish caught by poachers cannot be ascertained in a satisfactory manner; but the following facts throw considerable light on the subject. Mr Wilson declares, that "the number of fish taken in close-time is immense."—"I suppose many thousands have been taken out of the Tweed this last winter."—"The last winter the bailiffs took upwards of eighty nets out of the river in close-time. It has increased very much within the last three years." "The winters have been very mild, and they can perform those operations much easier in mild weather than when there is frost and snow on the ground, and there are more men out of employment;" p. 11. James Gil-

lies declares, "In the year 1820, I saw 250 salmon lying in one cellar in Perth, in the month of September;" p. 135. "I have seen upwards of a hundred killed in one night;" p. 136. In reference to the Tweed, he says, "My brother killed, in one night, 400 of salmon and grilses and upwards, at one hauling-place;" p. 139. And he adds, in reference to the facility of sale, "I never found any difficulty for any that I got; I always found a very ready market for them;" p. 135. And as to the buyers, he says, "They had generally people that took them and kippered them, using saltpetre to make them red, and sent them from Perth to Edinburgh and Glasgow;" p. 136. The evidence indeed in this Report, indicates these poaching operations to be carried on both night and day, occasionally under the very windows of the houses of our nobility, the Castles of Duplin and Kilfauns, and the Palace of Scoon. Where this poaching has been prevented, as it seems to have been done in the Moy at Ballina, Mr Little declares, "I consider that they had no protection for some years previous to 1816; by that protection it has risen from six tons to an average of sixty tons in a season;" p. 106. The same witness adds, "The Dublin market is just as regularly supplied with salmon during the close-season, as it is at any season of the year;" p. 116. How far these facts bear out Sir H. Davy in his assertion, that "the great northern fisheries, and the Irish fisheries, are much less productive than formerly," (p. 145.) the reader must determine. But if we believe the opinion of Mr Little, in reference to the Solway, to be true, and extend it, as supported by the preceding evidence, to all the other great fisheries, "I believe I can prove, from the dealers in salmon in the neighbourhood of the Solway Frith, that there were more killed in these nets by poachers, during the winter season of last year, than was killed during the proper season for killing salmon;" then must we conclude, that salmon are as abundant as ever, but poachers now enjoy a greater share than formerly, to the injury of the legal fisher.

2. *Stake-nets.*—This part of the evidence assumes three very different aspects. The river fisheries are said to have decreased, in consequence of the operation of the stake-nets in the estuaries and on the shore. The evidence on this subject exclusively refers to the Moray Frith, and the Frith of Tay. In reference to the Tweed, the decrease cannot be owing to stake-nets, for there they do not exist, (Mr Wilson says, "Never; there is not a stake-net within fifty miles of the Tweed;" p. 12.); but the other supposed causes of decrease which exist there, likewise prevail elsewhere. In reference to the Beauly, Mr Wilson declares, that "it has decreased considerably," owing "to the stake-nets and yairs in the Moray Frith;" p. 16. With these stake-nets he acknowledges himself very little acquainted, and ignorant of the breadth of the frith where they are placed, or of the quantity of fish which are caught in them. The evidence of the *decrease* is of a very doubtful character. "I have seen in the books 7000 salmon taken in the Beauly, and I have seen only 1500 or 1600 in a year." But, in reference to the quantity taken last year, he says, "I think between 2000 and 3000 salmon, and about 6000 grilse." Even the rent in 1814 was increased to £50 a-year. His uncle, the lessee, in regard to the concern, has "not a very material interest, for Lovat would take the fishery off his hand when he pleases."—"Lovat, last year, gave an abatement of 20 per cent, and the lessee is to pay a share of the expense of a law-suit against the owners of the stake-nets."—"Mr

Berry is the only tenant of the river; he sends his own fishermen, that are employed in the summer, to protect the river in winter;" p. 16—18.

Not more satisfactory is the evidence to prove the destructive tendency of the stake-nets on the river-fishing in the Tay. The general decrease of the Tay is distinctly avowed by Mr Bell; and, while he admits the destruction occasioned by poaching, and killing fry, he seems inclined to refer the evil chiefly to *the erection of stake-nets*, formerly in the estuary, and now only on the sea-shore. When the stake-nets were erected in the frith, it is here asserted that the river fisheries fell off in quantity; that when these were removed, the river fisheries increased. No evidence, unfortunately, is produced to confirm this statement. And it may be mentioned, as a singular circumstance, that, in the process before the Court of Session, the proof of the decrease of the river fisheries was considered by several of the Judges as too imperfect to warrant such an inference, and by none as amounting to demonstration. The evidence for the injury sustained at present by the sea-shore stake-nets, amounts to nothing. Thomas Proudfoot considers the stake-nets set up at Montrose as the cause of the decrease in the river Tay; they "take a great many of the fish that would come into the Tay;" p. 24.; but he is ignorant of the distance of these nets from the Tay; yet he believes they are destructive, because, in his opinion, the fish come from the north-east coast. Mr Bell considers that stake-nets on the shore of the Forth at Ely, would injure the Tay fishings; p. 52. In the absence of all proof, from the returns of river fisheries, we are here presented with some notices of the rents, as illustrating the injury occasioned by the stake-nets. But it appears that Lord Gray's fishing, before the erection of stake-nets, either in an estuary or upon the shore, was £3000, and that it is now between £3500 and £3700. In the interval, it has been as low as £1205; p. 26. Mr Halliday declares, "When I first came to the Tay, the rents of the upper fisheries were then about £4000 a-year for fifteen of the principal fisheries; and during the time of the stake-nets in the Tay, twelve of these fishings rented for above £6000 sterling per annum." In reference to the cause of the reduction in Lord Gray's fishings, he states, "Because the upper fishers had joined together, and fished them jointly; before that, there was a separation of companies at Perth, but Mr Bell and Mr Richardson's people fished their fishings together as one company; after that, there was nobody there to oppose them; before that time Mr Bell and Mr Richardson were two opposite companies;" p. 71.

The evidence of a decrease in the Frith of Tay from the *abolition of stake-nets*, is of a more unequivocal kind. Mr Halliday states, that the total produce of the Tay, when the stake-nets were in operation, amounted to between 50,000 and 60,000 salmon; and he says, "I do not believe the Tay has produced, since the discontinuance of the stake-nets, more than from 26,000 to 28,000 or 29,000;" p. 71. Mr Johnstone says, "Some of the properties that produced 2000 or 3000 salmon, and even 4000 a-year, are now not fished at all;" p. 42. Before the use of stake-nets, he says that the river fisheries produced annually about 30,000 salmon, and the frith fisheries about 4000; but that, by the use of stake-nets, the frith fishery rose to 30,000. It follows that, since 1812, 26,000 salmon, besides grilses, have annually been lost to the public.

The *increase* in the produce of the fisheries in those places where stake-

nets have been erected, is equally manifest. Mr Johnstone says, "I have caught above 500 salmon and grilses in *one stake-net*, and at *one time*, far from any river;" p. 47. "We have caught thousands going away from the nearest river, the Findhorn;" p. 48. In the Esk at Musselburgh, Mr Halliday declares, that had he no stake-nets, he would lose four or five hundred fish every year; p. 76. He says of one in the Forth, "I think the first tide after it was put up, we had about twenty-eight or twenty-nine salmon and grilses in it;" p. 77.

3. *Increase of natural foes.*—These are limited in the evidence to seals and grampuses. In regard to the *seals*, Mr Johnstone says, "I have often counted between fifty and sixty seals that lie a little from my house summer and winter." That they feed on the salmon is ascertained. "I have seen them chasing, catching, and eating them;" p. 47. Mr Halliday says, "I have observed from sixty to eighty seals in one flock, and I have seen three or four flocks within my view at Balmerino;" p. 74. "I have known one seal take six or eight fish in the course of two hours and a-half;" p. 75. The grampuses appear in April, and continue till October. They go up and down with the tide. "There are some hundreds;" p. 47. Mr Halliday says, "I have seen as much salmon in the stomach of a porpoise (grampuses are so called in the Tay) as a man could lift;" p. 76. In reference to the quantity of salmon consumed by these mammalia, he says, "I have often thought that they destroyed four or five times more than all the fishermen of the Tay;" p. 75. Since the removal of the stake-nets, these depredators have increased; p. 47. 75. Mr Little states, that there are few seals in the Solway (where there are stake-nets), but that they are numerous in Ireland. The grampuses are in all the sea-coasts around Scotland and Ireland. It is indeed probable, that, in the United Kingdom Seas, grampuses devour many more salmon than the inhabitants.

4. *Cultivation of the Land.*—Mr Halliday says, "Since the lands have been so much drained, the rivers fall in so fast, that fish cannot get up to the *higher parts* of the river so freely as formerly," p. 82; and Mr Little says, "I consider that the draining of the land in Scotland has been as injurious to the fishings as the limeing of it. Formerly the small waters, in consequence of the rains remaining long in the land and in the marshes, were a length of time in rising and falling; now they get up very rapidly, and fall very rapidly. The salmon, when they go up these little rivers to breed, deposit the spawn; and, at a season of the year when the spawn ought to rise from the gravel, it is left dry;" p. 117. These remarks can only apply to the lower and smaller streams of our estuaries, which flow through the cultivated districts, insignificant as salmon breeders, but are inapplicable to the higher branches of our principal rivers, which are fed by the mountains. What drainage has taken place in the Grampians, the Lammermoors, or the Cheviots?

Having thus stated the facts in the natural history of the salmon detailed in this Report, and the evils prevailing in our fisheries, it is time to advert to the *changes* in our fishing system which seem to be requisite.

1. *Close-time.*—The evidence contained in this Report demonstrates the inexpediency of permitting the fishing-season in *rivers* to commence before the 1st of May. In April, *the fry* are descending in "tens of thousands," and must be destroyed by the coble-net in great quantities, if used at all. The size of the mesh cannot prevent this destruction, since it becomes oblique while drawing on shore,

and the net passes into folds. But the fry are not the only sufferers. The *kelts* are likewise captured; and as the *females* usually descend at this period, their death must be unavoidable. Even in May, both fry and kelts may be destroyed, but the quantity would bear but a small proportion to those which had previously reached the sea. The fishing-season should terminate on the 1st of August. This is the month when the *red* fish, or those ready to spawn, begin to become numerous. The condition of the rivers, in reference to floods, varying in different seasons, the fishing-season should be rather *early* than late, to secure *always* an abundant supply of *breeding fish*. Were it not for the *habits* of the river proprietors, strengthened by their *vested rights*, the Legislature should *prevent all fishings in rivers*, as the breeding-ground of salmon, where the fish execute the duties of parturition, and where the young are hatched, but where at present the mother is surprised and taken in her weakness, and her progeny meet an untimely death.

In *estuaries*, and on the *sea-shore*, fishing may be practised at *all seasons*, as in such situations neither red fish, kelts, nor fry, are found. But there is one objection to this freedom, warranted by the habits of the fish.

The fishing-season should begin and end, in all parts of the kingdom, on *the same day*. It is true, that the condition of the fish varies with the seasons, in different rivers, and in different parts of the same river. But no law could accommodate itself to these variable circumstances. Experience here points out the remedy, having established the nature of the disease. Unless there be *one* time, poaching will prevail in the *close rivers*, and the produce will, in the market, compete with the fish from the open rivers. No statute could prevent this smuggling.

2. *Establishment of Stake-nets in Estuaries, and on the sea-shore.*—It has been demonstrated in this Report, that stake-nets do not injure the *fry*, and do not capture *red* fish or kelts. —They are the only efficient engine in estuaries and the sea-shore (but from their nature not more so than the coble-net in rivers), and greatly increase the value of the fisheries at those stations. They do not injure the river fishings, because they catch fish not inclined to enter rivers, and at a season when the rivers are in an unfit state to receive them. They capture the fish which would otherwise fall a prey to seals and grampuses, and they serve to reduce the number of the depredators. They are useful, in the estuaries, to the shipping as marks, (pp. 50. 79. 103. 126;) they employ many hands, (pp. 51. 80. 123;) they educate expert seamen, (pp. 51. 81. 104.)

Sir H. Davy assuming (though destroyed in evidence) that salmon belong in fact to the river in which they were spawned, affect a particular river, and always return to it, declares, "As *the old law* of the country was framed upon this principle, salmon-fisheries never having been considered as belonging to *the coast*, all stake-nets should be abolished, as they enable persons having no interest in the river to cut off almost entirely the supply of fish;" p. 145. Without entering into the rather singular dispute in political economy,—whether British subjects should be fed with salmon, or the preference given to seals and grampuses,—we shall rather advert to the *law* and the *reason*, as laid down by the latter, in reference to stake-nets. Had Sir Humphry Davy *examined* the *old law* on the subject, he never could have risked such a groundless *assertion*. In *Magna Charta*, he will find these words: "Oranes *kidelli* (wears, or stake-nets, Coke and Court of Session) deponantur de cetero peni-

tus per Thamesiam et Medweyam, et per totam Angliam, *nisi per costeram maris.*" He will find in 9th Henry III. c. 32. "All wears from henceforth shall be utterly put down by Thames and Medway, and through all England, *but only by the sea-coasts.*" And in 12th Edward IV. c. 7. "that all kidels by Thames and Medway, and throughout the realm of England, should be taken away (sinoun per les coaster del mear) *saving by the sea-banks.*" In the statute of Robert I. of Scotland, 1318, c. 12, everything in reference to wears or fixtures applies to these, "in *aquis* ubi mare fluit et refluit;" or, as it is expressed in the act 1424, c. 11 of King James I. "in *fresche watteris* quhar the sea fillis and ebs." It hence appears, in opposition to Sir Humphry Davy's statement, that stake-nets, or engines similar to *stake-nets, were permitted on the sea coast by the old law of the country,* though prohibited elsewhere. The *reason* given, that, by stake-nets, persons having no *interest* in the salmon, cut off the supply from the river heritors, to whom in fact they belong, will be found equally untenable. Let us see to what conclusion it would naturally lead us. If stake-nets fishings, in estuaries and on the shore, should be abolished, because fish are taken in these which belong to the place "in which they were spawned," then no fishings should be allowed, *even in a river,* below the lowest *spawning-ford,* such as Lord Gray's, where there is no spawning-ground. Again, upon the same principle, no fishing should be allowed, even at the lowest spawning-ford, because the proprietor may capture fish there in which he has no interest, which were not spawned on his ground, but which in fact belong to a higher ford. Hence, the Town of Perth should not be permitted to fish their fords, lest they catch (as they would do) salmon belonging to the spawning-fords of his Grace of Athole. The *proprietor of the uppermost spawning-ford* is alone safe from this objection, (though a straggler from a lower ford would occasionally find its way into his net,) and *should be the only fisher in the river,*—a conclusion which the deservedly celebrated individual did not probably anticipate. It seems necessary to speak freely, lest the influence of *name* should give currency to mistake.

The determination of the *stations* where stake-nets may with propriety be erected, near the mouths of rivers, seems not as yet to have occupied much of the attention of the Committee. Mr Little, indeed, is the only witness who delivers his opinion on the subject. He assumes, as had been proven in the Tay case by that acute engineer Mr Jardine, that the *river* ends at that *point* in the head of a frith where the sea is continually ebbing or flowing, or, to speak plainly, at *low-water mark;* and he says, "above that place, or within half a mile from it, down the estuary, or along the coast, no stake-nets should be allowed;" p. 123. This *point,* we may observe, must vary more or less in different rivers, from the mean level of the ocean, according to the size of the aperture or mouth of the estuary through which the tide enters and retires, and the quantity of water in the river opposed to it. A slight difference must likewise prevail between the low-water of spring-tides and of neap-tides, though Mr Jardine has proven, that the horizonal lines representing these gradually approximate in retiring from the mouth of an estuary to its head. But these differences do not perhaps deserve any very serious consideration. Indeed, we see no objection to the use of *stake-nets everywhere*

below this point. The fry and the kelts would not be taken by them; and as the channel or stream would be clear, no fish intent on ascending would be prevented. But it does not appear upon what principle Mr Little wishes to have half a mile, any more than ten miles, kept clear of stake-nets. No two rivers are alike. The *half mile* would have very different *powers*, in those rivers which have intervening estuaries, and in such as enter the sea directly. The Spey and the Tweed would be placed in different circumstances from the Tay and the Forth. Besides, by such a rule, the proprietor of a small stream joining the sea directly, would have it in his power to injure the property of his neighbours, through an extent of a mile of coast, by preventing the erection of stake-nets, and probably in the only bay or spot for twenty miles where they could conveniently be placed. We again repeat, that stake-nets could do no injury to fry and foul fish, if not erected in rivers or friths higher than low-water mark. Above this point, the net and coble is an efficient engine; below this point it possesses but feeble powers. Above this point, the stake-net would interfere with the channel or stream; below this point, it could only capture fish floating with the tide. Proprietors would thus be able to avail themselves of the natural advantages of their respective estates, without injury to others.

3. *Removal of Obstructions.*—Under this head, the condition of damdikes deserves the consideration of the Legislature. Openings should be made, through which the water may flow at stated periods, so as to allow of the ascent of red fish, and the deseent of kelts and fry to the sea; p. 119. In reference to the destruction of fry at mills, the following recommendation by Mr Halliday merits consideration:—"Placing a heck across the narrow part of the dam, and making a sluice through the damdike, at the upper side of the heck, would allow the fry to pass down the sluices into the bed of the river, and the heck would prevent the fry going down the mill-dam."—"If the heck was properly constructed, by placing it slanting, the under part of it inclining up the water, and the upper part of it down, it would raise all the dirt to the surface of the water;" p. 67. No wicker-work, or any similar obstruction, should be allowed to remain on stake-nets or cruives during the close season. The river should be free.

4. *Punishment of Poachers.*—Many laws occur in the statute-book on this subject, but they seem to be inapplicable. Hence, even the appointment of water-bailiffs is not successful in preserving the fisheries during the close season. Mr Wilson says, "at this very time we are expending about L.600 a-year for the protection of the Tweed, and to very little purpose;" p. 11. Premiums should be offered to encourage fishers to destroy seals, grampuses, and even porpoises, as the latter probably devour the fry.

Judging from the evidence contained in this Report, we have no hesitation in asserting, that were *the limits of close time determined by the habits of the fish*, stake-nets erected in suitable stations, obstructions removed, and poaching checked, our rivers and shores may be made to yield four times more salmon than they do at present, and the increase of the breed be promoted. We trust the Committee will resume its labours this session of Parliament; and, should the results be as interesting as the present Report, we may feel disposed to lay a digest of the evidence again before our readers.

Feb. 17, 1825.

CHAPTER III.

GEOGRAPHICAL DISCOVERY.

Northern Expedition.—Melville Island.—Russian Expedition along the Northern Shores of Siberia.—Subsidence of the Baltic.—China.

NORTHERN EXPEDITION.

On the 12th October, about noon, the Hecla arrived off Peterhead, where Captain Parry and two of his officers landed, and soon after proceeded post for London. On the same evening they passed through Aberdeen, stopping only to change horses. From the meagre accounts that have yet transpired, little more is known than that the grand object of the expedition has not been attained, and that, in short, no important discoveries have been made. Captain Parry attributes his failure to the loss of the Fury, which was wrecked at a time when he was led to entertain sanguine hopes of success. Her crew returned in the Hecla. All accounts concur in describing the health of the crews as excellent. Some letters state that no deaths had occurred during the voyage—others that they lost two seamen. By a letter which Captain Knight received on Friday, from his nephew, a lieutenant on board the Hecla, and which he immediately communicated to the Lord Provost, it appears that the ship was off the mouth of the Firth, on her passage to the Thames, on the day Captain Parry landed. The subjoined extract of a letter, addressed by a principal officer in the expedition to an eminent scientific gentleman in this city, contains the most interesting details that have yet been published :—

"*H. M. S. Hecla, Oct.* 12, 1825.

"DEAR SIR,

"We sailed from the west coast of Greenland on the 4th July 1824. In passing Davis' Straits we were beset 58 days in the ice. On the 9th September we cleared the ice, and on the 13th of the same month entered Barrow's Strait. The winter was now setting in fast; we therefore endeavoured to reach Port Bowen in Prince Regent's Inlet, which we effected with some difficulty on the 28th. By the 6th October we were completely surrounded with young ice. The winter passed more agreeably than could have been expected; we had a good library on board, and managed to raise a tolerable masquerade in one of the ships every fortnight. The winter was what might be called a mild one in that part of the world, the thermometer never exceeding 48½ degrees below Zero. During its continuance we had fine sport chasing white bears, 12 of which were

killed. White grouse were abundant in spring; we shot a great number of them. They were excellent, and proved a great luxury to the officers and men. The summer, which commenced on the 6th June, with a shower of rain, was very fine; the thaw went on rapidly. On the 19th July the ice broke up, and we bade farewell to Port Bowen, where we had passed nearly ten months. On the 23d we made North Somerset, and worked to the southward along its coast, until the morning of the 1st August, when unfortunately the Fury was driven on shore by the ice. Every effort was made to save her, but our exertions proving fruitless, she was abandoned on the 19th, and her crew taken on board the Hecla. Thus ended all our hopes of making the north-west passage, which seemed favourable till this accident. On the 1st September we left Regent's Inlet for England, and made the coast of Scotland on the 10th. We have been extremely fortunate during the voyage, not having lost a man either by disease or accident."

At a time when public attention is so earnestly directed to the progress of discovery, it may be interesting to notice some important facts regarding the Antarctic Seas, which have recently been brought to light by private enterprise. While the splendidly equipped expedition under Captain Parry was braving the dangers of the Northern Ocean, two small vessels, fitted out on mercantile speculation, were navigating a sea, hitherto unknown, at the other extremity of the globe. On the 17th September 1822, the brig Jane of Leith, 160 tons, and 22 men, commanded by Mr James Weddell, master in the Royal Navy, and the cutter Beaufoy, of London, 65 tons, and 13 men, commanded by Mr Matthew Brisbane, both provisioned for two years, sailed from the Downs on a sealing adventure in the Southern Hemisphere. James Mitchell, Esq. of London, and John Strachan, Esq. of Edinburgh, were co-owners with Mr Weddell; and to these gentlemen no small share of praise is due, for their liberal and enlightened conduct in making private emolument subservient to public utility. On the 7th November the vessels crossed the equator; on the 7th January 1823, ice islands were seen; and on the 11th they made the South Orkneys, which, on his return from a voyage made the preceding year, Mr Weddell had reported to the Commissioners for the Navy. After ascertaining that no land existed between the South Orkneys and the points of coast termed Sandwich Land, Mr Weddell, early in February, proceeded farther south, determined to prosecute a search beyond the tracks of former navigators.—On the 6th and 7th, in lat. 64°. 15′. long. 30°. 46′. they passed many ice islands, some of which were of an enormous size. One was thickly incorporated with black earth, and had apparently been disengaged from land covered with soil to a considerable depth. On the 14th, in lat. 68°. 20′. long. 29° 43′. 15″. ice islands were so numerous as almost to obstruct the passage of the vessels. On the 17th the water appeared discoloured. They were accompanied by all the birds common in these latitudes, particularly blue peterels, and by numbers of finned and hump-backed whales. On the 18th, latitude by observation, 72°. 38′. "not a particle of ice of any description was to be seen," and the weather was mild and serene. On the 20th the wind blew freshly from the south, and the atmosphere became very clear, but no land was in view—lat. 74. 15′. long. 34°. 16′. 45″. Here Mr Weddell, taking into consideration the lateness of the season, and the length of his homeward voyage, which included a thousand miles of sea strew-

ed with ice islands, resolved to take advantage of the favourable breeze and return. He named this hitherto unvisited part of the ocean King George the Fourth's Sea. The Jane and Beaufoy wintered at the Falkland Islands, and arrived at Falmouth, after an absence of nearly two years.

These particulars, gathered chiefly from Mr Weddell's account of his voyage, prove that open navigation exists beyond the ice islands which opposed a barrier to Captain Cook, and that, unless land intervenes beyond the 74th parallel, a navigable sea probably extends even to the South Pole. It is to be hoped, that Government will, without loss of time, follow up this interesting discovery by at least attempting to explore the new sea. The enterprise and talent which Mr Weddell has displayed, and the extensive information which he may be supposed to have acquired respecting the South Seas, in two protracted voyages, point him out as a person eminently qualified to accompany any expedition equipped for this purpose. Like Scoresby, in the Arctic zone, he has shown how much may be achieved by individual ability; and he has also given a guarantee, that, with the ordinary advantages which the Admiralty provides in such cases, he would not only meritoriously discharge the difficult duties of a commander, but greatly extend our knowledge of the Antarctic regions.

ARCTIC LAND EXPEDITION.

A letter has been received in Edinburgh from Captain Franklin, dated the 2d of June, at which time the enterprising travellers were 700 miles in advance of Cumberland House. The party were all well, and in good spirits, which had been heightened by the intelligence that the stores had reached the depot at the first wintering station.

MELVILLE ISLAND.

This island, which Government has pitched upon as a fit situation for a new settlement dependant on New South Wales, is situated in the gulf of Carpentaria, a vast bay containing many islands, on the north east coast of New Holland. According to the Gazetteer, it is about five miles long, and between one and two in breadth—low, destitute of wood, and with a sandy shelving beach. The south end lies in long. 136°. 52′. E. lat. 12°. 8½′. S. It is said to be well situated for the encouraging of trade with the Malays, and the islanders of the Indian archipelago; but the importance of its colonization to the settlements at Sidney and in Van Diemen's Land, will arise chiefly from the facilities it will afford for punishing refractory convicts. Many a ruffian at these places, who persists in a career of crime in defiance of all the minor punishments that have been invented, and holds in contempt even banishment to the Coal River, will tremble at the idea of transportation to Melville Island. The great gulf of Carpentaria stretches from Endeavour Strait to Cape Wilberforce. The shore is about 1200 miles in extent. It was formerly supposed that a great river intersected New Holland, nearly in this longitude, and some persons have even gone so far as to speculate on the probability of Macquarrie River, the famous stream discovered beyond the Blue Mountains in New South Wales, being that river. This gulf was accurately surveyed by Captain Flinders, in the beginning of the present century. According to his account, he found the soil on its borders poor, but the country in some places covered with an agreeable intermixture of grass and trees. From the small extent of Melville Island, and the few natural inducements it appears to hold out as a place

of settlement, we should imagine that it would have been more advisable to make the experiment on the continent itself—perhaps at Melville Bay, a harbour also at the west entrance of the gulf of Carpentaria, and described by Captain Flinders as the best on the coast. The entrance from the north-west is four miles wide, and free from danger, and the bay affords every-where good holding ground. It is to be hoped that the settlers of Melville Island will have to encounter fewer hardships than fell to the lot of those unhappy men who were sent from similar motives to Norfolk Island, when the colony at Sidney was in its infancy, and required to be purged of the more profligate part of its inhabitants. At the same time, considering the advantage Norfolk Island possesses in point of fertility, we can scarcely augur a happier result.

RUSSIAN EXPEDITION ALONG THE NORTHERN SHORES OF SIBERIA.

The Russian Government had long formed the project of exploring the north coast of Siberia. M. de S. was sent out for this purpose; but his researches were extremely limited, and he only described a part of the coast, to a distance of about a hundred versts beyond the eastern part of the Kolyma. Toward the year 1822, it was resolved to send out a new expedition for exploring these countries. Three young officers, MM. Wrangel, Anjou, and Matuchkin, were charged with it; they were occupied four years in it, and justified the confidence of the government, by the courage, prudence, and zeal which they evinced in the discharge of this duty. They succeeded in making a description of the whole north coast of Siberia, in despite of numerous obstacles, the extreme rigour of the climate, and the dangers to which they were exposed; for the Tchouktchis had already destroyed two detachments sent out for the same purpose. M. Anjou has described the coast from the Uralian Chain, or from the river Ob to the Kolyma, the other two gentlemen from the Kolyma to the promontory of the Tchouktchis. Not content with exploring the coast, these travellers made an excursion also toward the north, over an extent of continuous ice, to the place where the sea is open, which forms nearly five hundred versts, of the coast of Behring's Straits. It was in this place, which faces the eastern part of the north coast, and is inhabited by the rein-deer Tchouktchis, that they perceived mountains at a distance of about a hundred versts. M. Wrangel conceived the project of getting to them. He was already pretty near, when the piece of ice on which he was placed became detached from the mass, and he was tossed about by the waves for five days in succession, with seven other persons, his dogs and equipage, until at length, after they had been several times upon the point of being swallowed up, the piece of ice was again united to the mass. There is a tradition among the Tchouktchis, that the strait which separates them from the opposite shore, towards the north, was not covered with ice, and that the inhabitants formerly traversed it in *baydars*, a sort of boat. They relate that a period, not very remote, (for all the inhabitants remember it still,) some Tchouktchis, to the number of seven or eight, accompanied with a woman, crossed the ice to go towards these mountains to fish for morses, and that a long time after, the woman returned to the country by the way of the Kurile Isles, and brought the news that her companions had been all massacred. This woman was sold into another part of the country, and

after having passed from hand to hand, was carried to Prince of Wales' Land, from whence she found means of returning to her own country. From this account, it is to be supposed, that the country which Wrangel had in view to visit, is nothing else than an island. The people who inhabit the islands nearest Siberia, make use of rein-deer, which renders it probable that they are only a colony of Tchouktchis, more especially as their languages are much allied. The Tchouktchis are in general large and well made; they have regular features, their nose is not flat, but their cheeks are very prominent. Our travellers also saw other islands, which they named New Siberia. The route which they took to get to them may be seen upon the chart of the famous pedestrian traveller Cochrane, where it is traced with great fidelity. They made very extensive excursions in all directions, but saw no land. In their land journeys, they rode upon horses or rein-deer, but they preferred the former. With regard to sledge-travelling with rein-deer, it is very convenient upon ice. They made use of a sort of large sledge called *narta*, drawn by twelve or thirteen dogs; these animals were always of great use to them, in defending them from the white and black bears, and wolves, as well as by their astonishing sagacity. Their instinct always led them to find the best road, and when the travellers thought themselves strayed, the dogs brought them back to the way. The sagacity of these animals was such, that after having made a number of turns, they took the shortest way to return. The travellers passed several weeks upon the ice, sometimes upon enormous pieces covered with grey snow, sometimes upon thinner layers, which frequently separate from the mass, so as to be carried along by the current, and tossed about by the waves. In these critical moments, the dogs rendered them innumerable services; in the places where the ice was thick, they ran with rapidity upon the snow, barked, bit one another, and appeared intractable; but as soon as the route became dangerous, they became gentle, circumspect, and docile; they often walked upon pieces of ice, which were not more than half an inch thick, with the greatest precaution, and seemed to advance only according to the order of the person carried on the sledge. MM. Wrangel and Matuchkin remained once for seventy days upon the ice, at a distance of several hundred versts from the shore. They were attended by several *nartas* laden with provisions; they buried these provisions under the snow and ice, and continued their journey, carrying with them what was absolutely necessary; and when their provisions were exhausted, they returned for what they had left. They did not fail to make astronomical observations wherever they could, but the fogs often prevented them. These fogs were so thick, that our travellers, drawn in their sledges, sometimes could not see the dogs which drew hem. Frequently snow-storms overwhelmed the tents which served for their abode, and it was with much difficulty, when the storm abated, that they got themselves extricated. During the months of November, December, and January, when the intensity of the cold became insupportable, our travellers took refuge in felt cabins or tents, where the water froze upon the floor, and the ice rose to the height of upwards of two feet. A mass of ice, about five inches thick, served them for a window. In this icy region, the earth produced only heath and a sort of plant peculiar to the country; in summer, the sun did not leave the horizon for two months, and in winter, it did not appear for the same period of time. The maximum heat, in the middle of summer, is above fifteen degrees of Reaumur's thermometer; it freezes

at night, or when the sun is upon the decline. The dazzling whiteness of the snow produced diseases of the eyes; the natives wear a sort of mask formed of the bark of trees, in which very narrow slits are made for the eyes. The Russian officers wore a piece of crape folded four times; at the beginning they neglected to avail themselves of this contrivance, and were rendered nearly blind: they learned, however, to cure this malady, by introducing tobacco oil into the eyes, a remedy which, although effectual, has the disadvantage of exciting acute pain. Their ordinary food consisted of fish, and rein-deer, and bear's flesh; this last had the property of strengthening them, but it also produced violent agitation in the blood, and prevented them from sleeping. The natives are poor, do not practise any trade, and have no other occupation than that of fishing and hunting; yet there are Russian merchants who go to these countries for trade.

SUBSIDENCE OF THE BALTIC.

A very singular and interesting fact has been ascertained respecting the level of the Baltic. It had been long suspected that the waters of this sea were gradually sinking; but a memoir, published in the Swedish Transactions for 1823, has put the change beyond a doubt. Mr Buncrona, assisted by officers of the Swedish piloting establishment, has examined the Swedish coast with great care from lat. 56 to 62, and Mr Halstrom has examined those of the Gulf of Bothnia. The results of both inquiries are given in the form of a table; and though, as might have been expected, they are not completely uniform, they correspond sufficiently to place the subsidence of the waters beyond dispute. The Baltic, it is to be observed, has no tides, and is therefore favourably situated for making observations on its level; but with regard to the periods within which the changes observed have taken place, it was of course necessary to rely on records or on oral testimony. At the latitude of 55, where the Baltic unites with the German Ocean through the Categat, no change seems to be perceptible. But from latitude 56 to 63, the observations show a mean fall of 1½ foot in 40 years, or 4-10ths of an inch annually, or 3 feet 10 inches in a century. In the Gulf of Bothnia, the results are more uniform, and indicate a mean fall of 4 feet 4 inches in a century, or rather more than half an inch annually. These facts are very remarkable; and as we like to be honest, and give authorities, we think it right to mention, that they are taken from the last number of the Annals of Philosophy. But whence arises this singular change? Is there a similar depression of the level of the sea everywhere, in consequence of the gradual waste of the waters, occasioned by the rocks, sands, and other solid materials of the globe, imbibing a portion which they never return? This is very improbable; and though the alternations of the tide might render the detection of a small change difficult, one of several feet must assuredly have made itself known. If the phenomenon is entirely local, shall we conclude with Playfair, that an expansive force placed in the interior of the earth, is gradually heaving up the land, while the true level of the waters remains unaltered; and that this local change is part of the grand process by which the present continents rose above the sea? This is the simplest, but not perhaps the most probable solution. Is it not possible that there may be causes, analogous to magnetism—that there may be a positive shifting, for instance, of masses of fluid matter in the interior of the globe, which may change the equilibrium of

its parts; and that the waters, which obey the law of gravitation, may thus get a determination from one point of its surface to another? Perhaps it may be found that these changes, instead of being constantly progressive, are parts of a great cycle, that they oscillate about a given point, and after a long series of years, regain the position in which they began. Philosophical observers who come 500 years after us, will have data for determining these and many other questions which baffle the powers of science at the present day. In the mean time, it must be confessed, that the Hyperborean sages, who trouble themselves about the future, have strange prospects before them. The Baltic is very shallow at present, and if its waters continue to sink as they have done, Revel, Abo, Narva, and a hundred other ports will by and by become inland towns; the Gulfs of Bothnia and Finland, and ultimately the Baltic itself, will be changed into dry land; and shepherds will tend their flocks, and ploughmen drive their steers, and cities and palaces rise up, where now the fishes glide, and the billows roar. The change will be exactly the reverse of that described by Ovid—

> One climbs a cliff; one in his boat is borne
> And ploughs above, where late he sow'd his corn.
> Others o'er chimney tops and turrets row,
> And drop their anchor on the meads below.
> And where of late the kids had cropt the grass,
> The monsters of the deep now take their place.
> Insulting Nereids o'er the cities ride,
> And wondering dolphins through the palace glide.

CHINA.

St Petersburgh, Dec. 1.—Mr Timkousky, who recently returned from China, has obtained information respecting the military force of that large empire, which may be considered as very interesting. The army, in a numerical view, is very powerful; but, in reality, its strength is not by any means formidable. It is generally stated, that the number of troops amount to 1,000,000 infantry, and 300,000 cavalry. This statement he considers as exaggerated. The regular troops are divided into four divisions, according to the different nations. The first division of 67,800 men, is composed of Mandjours; it is the elite of the army, and those who serve in it enjoy great privileges. The second division of 21,000, is composed of Mongols. The third division consists of 27,000 Chinese; the ancestors of these men co-operated with the Mandjours, in the conquest of China. The fourth division, and that which is held in the least estimation, is formed from the aborigines; the number is 500,000 men; they are disseminated in the garrisons in the interior of the empire. To these must be added 125,000 militia, forming a total of 740,000, of which 175,000 are cavalry. There is, besides, an Angolo cavalry, which may be assimilated to our irregular troops of the Don and Oural. The number cannot be exactly ascertained; it is said to amount to 500,000. All the Chinese soldiers are married, and their children are inscribed, at their birth, on the army list, and serve to recruit the corps to which they belong. Every soldier of the 1st, 2d, and 3d divisions, is provided with arms, a horse, a house, and rice, and receives as monthly pay, three or four lanes (six or eight rubles); his clothes are supplied at his own expense. The consequence of this regulation is, that the men wear all the colours of the rainbow, and great confusion frequently arises. Government allows the 4th division to cultivate certain lands appropriated to that purpose, and no other provision is made for the soldiers; they live on the

produce. The army is never in want of recruits; the poor are always glad to enlist, in order to avoid hunger and misery. The expenses incurred by government in keeping up their force are said to amount to 87,400,000 lanes (600,000,000 of roubles) and yet it is impossible to conceive an army to be more in want of discipline than that of the Chinese. The late Emperor Dziazzin issued a proclamation, in 1800, in which he recalls to the memory of the Mandjours their ancient exploits, and reproaches them with their want of discipline and military talents, tells them that the Chinese are absolutely better troops—and yet, adds the Emperor, a few of your ancestors conquered the whole of this mighty empire.